Draft
Remedial Investigation
Site-Specific Field Sampling Plan,
Site-Specific Safety and Health Plan, and Site-Specific Unexploded Ordnance Safety Plan Attachments
Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7)

Fort McClellan
Calhoun County, Alabama

Task Order CK19
Contract No. DACA21-96-D-0018
IT Project No. 838936

October 2002

Revision 0

Draft
Remedial Investigation
Site-Specific Field Sampling Plan Attachment
Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7)

Fort McClellan
Calhoun County, Alabama

Prepared for:

U.S. Army Corps of Engineers, Mobile District
109 St. Joseph Street,
Mobile, Alabama 36602

Prepared by:

IT Corporation
312 Directors Drive
Knoxville, Tennessee 37923

Task Order CK19
Contract No. DACA21-96-D-0018
IT Project No. 838936

October 2002

Revision 0

Table of Contents

Page

Page

Table of Contents (Continued)

List of Tables

List of Figures

List of Acronyms

See Attachment 1 – List of Abbreviations and Acronyms.

Executive Summary

In accordance with Contract Number DACA21-96-D-0018, Task Order CK19, IT Corporation (IT) will conduct a remedial investigation (RI) at Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7), at Fort McClellan, Calhoun County, Alabama. The purpose of this RI site-specific field sampling plan (SFSP) is to provide technical guidance for the sampling activities proposed at Training Area T-5 Sites. Training Area T-5 Sites are the following:

- Former Detection and Identification Area, Parcel 180(7)
- Training Area T-5, Parcel 182(7)
- Blacktop Training Area, Parcel 511(7)
- Fenced Yard in Blacktop Area, Parcel 512(7)
- Dog Training Area, Parcel 513(7)
- Old Burn Pit, Parcel 514(7)
- Dog Kennel Area Parcel 516(7).

The primary objectives of this RI are to determine the nature and extent of contamination at the Training Area T-5 Sites observed during previous site investigations and to identify the site-related chemicals that pose an unacceptable risk to human health and the environment. IT will collect samples to characterize the source, nature, and extent of contamination at the Training Area T-5 Sites. The data collected will also be used to evaluate the level of risk to human health and the environment posed by releases of potential site chemicals.

IT conducted site investigations at the T-5 Sites in 2001 and 2002. Previously, the Training Area T-5 Sites were investigated by Science Applications International Corporation. The results of the previous investigations conducted at the Training Area T-5 Sites are presented in Chapter 2.0 of this SFSP.

Parsons Engineering Science, Inc. (Parsons) conducted an engineering evaluation/cost analysis investigation in 2001 at the chemical warfare material (CWM) sites on Main Post to address the potential presence of CWM or other subsurface disposal using geophysical surveys, excavation of suspect anomalies, continuous air monitoring, soil sampling, and laboratory analysis of the soils for chemical agents and chemical agent breakdown products. The CWM engineering evaluation/cost analysis investigation did not find any evidence of soil contamination by chemical agent. Based on the results of soil sampling and analysis, Parsons stated it could be inferred there are not any sources of CWM in the environment on the Main Post. Thus, Parsons concluded that current and future human health risks due to exposure to CWM at this site are very small. As a result of the CWM investigation by Parsons, USACE-Huntsville Center issued a release of CWM sites on the Main Post to conduct hazardous, toxic, and radiological waste investigations, a copy of which is attached to this SFSP.

As part of the RI at Training Area T-5 Sites, IT will collect 48 groundwater samples (22 proposed monitoring wells and 26 pre-existing monitoring wells), 11 surface soil samples, 11 subsurface soil samples, 10 depositional soil samples, 1 surface water sample, and 1 sediment sample at this site. Potential contaminant sources at Training Area T-5 Sites include volatile organic compounds, semivolatile organic compounds, and metals. Chemical analyses of the samples collected during the field program will include volatile organic compounds, semivolatile organic compounds, total metals, and chemical agent breakdown products. The sediment sample will be analyzed for total organic carbon and grain size. Results from these analyses will be compared with site-specific screening levels, ecological screening values, and background values to determine if potential site-specific chemicals are present at the site at concentrations that pose an unacceptable risk to human health or the environment.

This RI SFSP will be used in conjunction with the installation-wide sampling and analysis plan, the site-specific safety and health plan, and the site-specific unexploded ordnance (UXO) safety plan. The sampling and analysis plan includes the installation-wide safety and health plan, waste management plan, ordnance and explosives management plan, and quality assurance plan. Site-specific hazard analyses are included in the site-specific safety and health plan and the site-specific UXO safety plan attachments.

The U.S. Army Corps of Engineers-Huntsville requires that work conducted at potential CWM sites use UXO anomaly avoidance techniques. Therefore, prior to initiating field activities at Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7), IT will conduct UXO avoidance activities as outlined in Appendix E of the installation-wide sampling and analysis plan and the attached site-specific UXO safety plan. Surface sweeps and downhole surveys will be conducted to identify anomalies for the purpose of UXO avoidance.

At the completion of the field activities and sample analyses, draft, draft final, and final RI summary reports will be prepared. Reports will be prepared in accordance with current requirements of the U.S. Environmental Protection Agency Region 4 and the Alabama Department of Environmental Management.

At the completion of the RI field work, a feasibility study (FS) will be conducted. The FS will identify, develop, screen, and evaluate remedial alternatives for contaminated media at the site as required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The FS report will be prepared in accordance with the guidelines, criteria, and considerations set forth in the 1988 U.S. Environmental Protection Agency guidance document entitled *Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA, Interim Final*. The FS will provide the Base Realignment and Closure Cleanup Team sufficient data to select a feasible and cost-effective remedial alternative that will protect human health and the environment.

1.0 Project Description

1.1 Introduction

The U.S. Army is conducting studies of the environmental impact of suspected contaminants at Fort McClellan (FTMC) in Calhoun County, Alabama, under the management of the U.S. Army Corps of Engineers (USACE)-Mobile District. The USACE has contracted IT Corporation (IT) to provide environmental services for the remedial investigation (RI) at the Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7), under Task Order CK19, Contract Number DACA21-96-D-0018.

This RI site-specific field sampling plan (SFSP) has been prepared to provide technical guidance and rationale for sample collection and analysis at the Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7) (Figure 1-1). The objective of this investigation is to further characterize the potential contamination resulting from training activities that occurred at these sites and to better define the nature and extent of groundwater and soil contamination observed during the previous site investigation (SI) by IT (IT, 2000a). The scope of the SI was outlined in the document *Chemical Warfare Material Sites – Agent ID Area (Parcel 509), Training Area T-6 (Naylor Field) (Parcel 183), Blacktop Training Area (Parcel 511), Fenced Yard in Blacktop Area (Parcel 512), Dog Training Area (Parcel 513), Dog Kennel Area (Parcel 516), Training Area T-5 (Parcel 182), Former Detection and Identification Area (Parcel 180), Old Burn Pit (Parcel 514), CBR Proficiency Area (Parcel 517), and Old Toxic Training Area (Parcel 188), Fort McClellan, Calhoun County, Alabama* (IT, 2000a). The results of the SI are presented in Chapter 2.0 of this SFSP.

The primary objectives of the RI are to determine the nature and extent of contamination at the Training Area T-5 Sites and to identify the site-related chemicals that pose an unacceptable risk to human health and the environment. IT will collect samples to characterize the source, nature, and extent of contamination at the Training Area T-5 Sites. The data collected will also be used to evaluate the level of risk to human health and the environment posed by releases of potential site-specific chemicals (PSSC). This RI SFSP will be used in conjunction with the site-specific safety and health plan (SSHP), the site-specific unexploded ordnance (UXO) safety plan, the installation-wide sampling and analysis plan (SAP) (IT, 2002a), and the installation-wide work plan (IT, 2002b). The SAP includes the installation-wide safety and health plan, monitoring well installation plan, waste management plan, ordnance and explosives (OE) management plan, and quality assurance plan (QAP). Site-specific hazard analysis is included in the SSHP attachment.

1.2 FTMC Site Description and History

FTMC is located in the foothills of the Appalachian Mountains of northeastern Alabama near the cities of Anniston and Weaver in Calhoun County. FTMC is approximately 60 miles northeast of Birmingham, 75 miles northwest of Auburn, and 95 miles west of Atlanta, Georgia. FTMC consists of three main areas of government-owned and leased properties: the Main Post, Pelham Range, and Choccolocco Corridor (the lease for Choccolocco Corridor terminated in May 1998). The size of each property is presented below:

- Main Post 18,929 acres
- Pelham Range 22,245 acres
- Choccolocco Corridor 4,488 acres.

The Main Post is bounded on the east by the Choccolocco Corridor, which connects the Main Post with the Talladega National Forest. Pelham Range is located approximately five miles west of the Main Post and adjoins the Anniston Army Depot on the southwest. Pelham Range is located to the west of U.S. Highway 431, approximately five miles from the Main Post.

FTMC is under the jurisdiction of the U.S. Army Training and Doctrine Command. Until September 1999, the installation housed three major organizations, the U.S. Army Military Police School, the U.S. Army Chemical School (USACMLS), and the Training Center (under the direction of the training brigade), in addition to other major support units and tenants.

In 1917 the U.S. government purchased 18,929 acres of land near Anniston for use as an artillery range and a training camp due to the outbreak of World War I. The site was named Camp McClellan in honor of Major General George B. McClellan, a leader of the Union Army during the Civil War. Camp McClellan was used to train troops from 1917 until the armistice. It was then designated as a demobilization center. Between 1919 and 1929, Camp McClellan served as a training area for active army units and other civilian elements. Camp McClellan was redesignated as Fort McClellan in 1929 and continued to serve as a training area.

In 1940, the government acquired an additional 22,245 acres west of FTMC. This tract of land was named Pelham Range. In 1941, the Alabama legislature leased approximately 4,488 acres to the U.S. government to provide an access corridor from the Main Post to Talladega National Forest. This corridor provides access to additional woodlands for training.

The U.S. Army operated the Chemical Corps School at FTMC from 1951 until the school was deactivated in 1973. The Chemical Corps School offered advance training in all phases of chemical, biological, and radiological warfare to students from all branches of the military service.

Until closure in September 1999, activities at FTMC could be divided into support activities, academic training, and practical training. Support activities included housing, feeding, and moving individuals during training. Academic training included classroom, laboratory, and field instruction. Practical training included weapons, artillery and explosives, vehicle operation and maintenance, and physical and tactical training activities.

1.3 Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7), Site Descriptions and Histories

Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7), site descriptions are summarized below from the SI SFSP (IT, 2000a) and the *Final Chemical Warfare Materiel (CWM) Engineering Evaluation/Cost Analysis (EE/CA)* (Parsons Engineering Science, Inc. [Parsons], 2002).

Former Detection and Identification Area, Parcel 180(7). The Former Detection and Identification Area, Parcel 180(7), is located southwest of Building 3185 and covers an area of approximately one-half acre on the west side of Rucker Street (formerly 13th Avenue) (Figure 1-2). This area was used from some time in the 1950s until 1973 for training in the detection and identification of CWM. CWM used at this location may include simulants, distilled mustard (HD), Sarin (GB), carbonyl chloride (CG), cyanogen chloride (CK), dichloroformoxime, hydrogen cyanide (AC), and the decontaminants supertropical bleach (STB), and Decontamination Solution Number 2 (DS2) (Environmental Science and Engineering, Inc. [ESE], 1998). It is also believed that the U.S. Navy used the site in the late 1950s for the detection of HD (Parsons, 2002). Parsons lists the agent simulants, CK, CG, phosgene oxime (CX), and AC as possibly being used in training exercises (Parsons, 2002). Portions of this area are currently fenced and posted (Weston, 1990).

Weston reported that several types of live CWM may have been used here and that STB and DS2 were used on surface soils, presumably during final decontamination before the USACMLS transferred from FTMC to the Aberdeen Proving Ground, Edgewood Area, in 1973 (Weston, 1990). At some time before 1973, a pit was dug on the site and all training aids (i.e., structures) from the site, as well as a building from Area T-4, were burned twice and buried (Parsons, 2002). This pit still retained the contents of that burial and was reportedly marked for location with a marker (Stake F). Based on a notation on a site map in the Installation Assessment Records, a location in the northern portion of the site was used for GB demonstration on goats (Parsons, 2002).

Personnel interviewed during the environmental baseline survey (EBS) site visit who had participated directly in operations at this site report that no training materials (i.e., CWM) contacted the ground and that no disposal activities occurred at this location, to the best of their knowledge (ESE, 1998). Accounts of personnel interviewed during the EBS site visit differ regarding the CWM used. Some sources indicate that only simulants were used at this location, while others recall that dilute CWM-containing mixtures were used to train troops. Vials of simulated CWM (dilute live CWM, according to some sources) were reportedly placed into containers atop poles in the training area. The poles were approximately 3 feet tall, approximately 24 in number, and are visible on 1964 aerial photos. Simulant Chemical Agent Identification Training Set (SCAITS) kits were used at the Former Detection and Identification Area. Vials in old SCAITS kits of the 1950s reportedly contained a very low concentration of CWM. There were not any spills reported at this site (ESE, 1998). In 1973, the surface was declared clean by the U.S. Army Toxic and Hazardous Materials Agency and FTMC USACMLS and the area was authorized for surface use only (ESE, 1998).

FTMC personnel reported that other training activities, known as "G-shoots," were conducted at a nerve agent demonstration area that was located in the northern portion of the fenced Former Detection and Identification Area (ESE, 1998). The chemical warfare agent (CWA) GB was used in this training. The operation involved placing one drop of GB on the nose of a goat, observing symptoms, then reviving the animal with an intramuscular atropine injection. Reportedly, there was very little chance of CWA release during this exercise, due to the small quantities on hand and controlled usage.

Training Area T-5, Parcel 182(7). Training Area T-5 is also known as the Former Area T-5: Former Toxic Hazards Detection and Decontamination Training Area. It is located between Sunset Hill and Howitzer Hill, south of Building 3174, at the end of Rucker Street (formerly 13th Avenue). The site covers approximately 10.5 acres (Figure 1-2). For the purposes of investigation, the Dog Kennel Area, Parcel 516(7), was separated from the Training Area T-5, Parcel 182(7), to be investigated with the Dog Training Area, Parcel 513(7). Training Area T-5 was reportedly used from 1961 to 1973. The site is posted and partially fenced (the fence is missing at the northern boundary). The operations conducted here reportedly involved detection and decontamination of CWM, including HD, O-ethyl-S-(diisoproplaminoethyl)-methylphosphonothiolate (VX), GB, and the biological simulants *Bacillus globigii* (BG) and *Serratia marcescens* (SM) (Parsons, 2002). The decontaminant chemicals STB and DS2 were probably also used here. Training was likely confined to small sites within a fenced, controlled area.

Personnel interviewed during the EBS site visit report that explosive ordnance disposal (EOD) personnel formerly conducted "render-safe" exercises on munitions (typically artillery shells) in this area (ESE, 1998). EOD personnel placed the munition on the ground and poured a vial of a specific live CWA over the munition. The EOD reaction team then identified the CWA, decontaminated the munition, and packed it for transport. Exercises reportedly took place no more than 50 meters off the road. Some reports maintain that training at Training Area T-5 used simulated CWM rounds only and that water was used as the decontaminant rather than STB or DS2 (ESE, 1998). Training sites were decontaminated and checked at the completion of each exercise (Parsons, 2002). Following completion of training at this site, all excavations were filled in accordance with standard operating procedures; training aids were decontaminated, burned twice, and sent to the landfill, or they were renovated and shipped to Redstone Arsenal (Parsons, 2002).

Previous reports speculated that this may be the site of a 110-gallon HD spill which reportedly occurred in 1955 (Weston, 1990). None of the personnel interviewed during the EBS site visit could recall a 110-gallon spill, nor could they imagine a scenario during which a spill of this magnitude could occur. However, the HD simulant molasses residuum was delivered in 55-gallon drums. Site soils were reportedly chemically decontaminated, excavated, and disposed of at Range J (ESE, 1998).

Blacktop Training Area, Parcel 511(7), and Fenced Yard in Blacktop Area, Parcel 512(7). The Blacktop Training Area, Parcel 511(7), is addressed with the Fenced Yard in the Blacktop Area, Parcel 512, as identified in the *Archives Search Report* (ASR) (USACE, 2001). The area is a little over three acres and is primarily an "asphalt parking lot" type located area along the east side of Reggie Avenue (formerly 12th Avenue), with viewing stands (bleachers) on both ends of the area and an inner fenced-in portion (Figure 1-2) (Parsons, 2002). The fenced yard in the Blacktop Area is almost one-half acre in addition to the three acres in the Blacktop Area. The fence was removed at some unknown date, but parts of the fence posts remain.

The Blacktop Training Area was identified on the 1956 map of the Chemical Corps Training Areas and on the 1969 Chemical School Orientation Map (Parsons, 2002). Various demonstrations may have taken place here, such as decontamination training, but its exact use is unknown. The area was reportedly used for training in the use of flamethrowers, decontamination equipment, and smoke generators. The Fenced Yard, enclosed by the high fence, was believed to have been used to store agent or for toxic agent training. However, it may be a more recent structure (Parsons, 2002).

The analysis of historical aerial photographs shows that the area was cleared in the early 1940s and paved sometime after the 1954 aerial photograph was taken (Parsons, 2002). After the area was paved, very few changes occurred that are visible in the aerial photographs. The one change that did occur was that the fenced area (Fenced Yard in Blacktop Area, Parcel 512) on the western edge of the pavement first shows up in the 1982 aerial photograph (Parsons, 2002). Anomaly features seen on the photographs at the north and south ends of the paved area are bleachers, suggesting that training demonstrations took place here (Parsons, 2002).

Historical documents do not indicate the use of specific CWM at this site. Decontamination training may have taken place, and it is not known if live agent was used (Parsons, 2002). The fenced area may have been used for storage or demonstrations of agent, but no documented evidence of such use was found. Training involving flame and smoke agents has also been reported for this site; however, these activities are no longer considered CWM-related (Parsons, 2002).

Dog Training Area, Parcel 513(7), and Dog Kennel Area, Parcel 516(7). The Dog Training Area, Parcel 513(7), is located at the south end of Reggie Avenue (formerly 12th Avenue) and near the Dog Kennel Area, Parcel 516(7) (Figure 1-2) (Parsons, 2002). The area has been recently mowed and cleared; however, it is no longer in use (Parsons, 2002). Both areas are approximately one-acre sites.

The site was used for training dogs for the U.S. Army Military Police School, and remnants of the training obstacles were still in existence in September 1998 but have since been removed (Parsons, 2002). A large, blistered/corroded concrete pad which was surrounded by a high fence is located within the area and may have been used to store agents or to conduct toxic agent training in "Transfer Operations," since the Depot Area was across the road from this area (USACE, 2001).

An analysis of historical aerial photographs revealed that this area contained numerous buildings in the 1940s, and the concrete pad is one of many building foundations from that era. More recent aerial photos showed several cleared areas that were likely used for dog training, but there are not any suspect CWM training areas (Parsons, 2002).

A site visit by Parsons in February 1999 showed the Dog Training Area was cleared of former dog training aids except for the concrete pad located at the site. This pad is heavily blistered and corroded, unlike other foundation pads in the vicinity (Parsons, 2002).

The Dog Kennel Area was identified in the ASR as having a possible storage area in the inner yard that could have been used for toxic agents. The Dog Kennel Area is shown on the 1969 Chemical School Orientation Map as being a part of Training Area T-5. Mustard confidence training, which used drops of mustard, may have taken place within the Quonset hut located inside the perimeter fence (USACE, 2001). However, historical aerial photographs did not indicate the likelihood of disposal within these areas (Parsons, 2002). Small quantities of HD may have been used at this site. However, the reported use would likely have occurred within the confines of the structure in the fenced area. Parsons found no evidence of a burial pit at the site during a site visit (Parsons, 2002).

Old Burn Pit, Parcel 514(7). The Old Burn Pit, Parcel 514(7), is located in the woods behind Motor Pool 3100 on Rucker Street (formerly 13th Avenue) and covers an area of 0.15 acres. It is across the dirt road and just to the west of the northwest corner of the Former Detection and Identification Area, Parcel 180(7) (Figure 1-2). This site was identified for consideration during the field visit to collect information for the ASR (USACE, 2001). The site appeared to be a burn pit. Although nothing is known about the site and this area is not specifically listed as hosting chemical training, it was selected for further sampling to ensure that CWM was not present (Parsons, 2002).

The aerial photograph analysis conducted by Parsons does show a well defined cleared area in the 1961 aerial photograph that coincides with the location of the burn pit (Parsons, 2002). A site visit by Parsons in February 1999 revealed the area behind Motor Pool Area 3100 to be wooded, but the remains of the pit were still visible. The pit was covered over with a wire mesh and contained some remnant metallic objects within it (Parsons, 2002).

CWM EE/CA. In 2001 Parsons conducted an EE/CA investigation at the CWM sites on Main Post to address the potential presence of CWM or other subsurface disposal using geophysical surveys, excavation of suspect anomalies, continuous air monitoring, soil sampling, and laboratory analysis of the soils for chemical agents and chemical agent breakdown products. Based on a historical review and on the sampling and analysis activities performed during this CWM EE/CA investigation, along with other types of investigations, Parsons concluded that no residual chemical agents or degradation products exist in the sampled media. Therefore, the probability of current or future risk of human exposure to chemical agents is very small. Parsons recommended "no further action" for Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7). In addition, any warning signs for CWM previously posted at these sites as precautionary measures should be removed (Parsons, 2002).

As a result of the CWM EE/CA investigation by Parsons, USACE-Huntsville Center issued a release of CWM sites on the Main Post to conduct hazardous, toxic and radioactive waste (HTRW) investigations (Attachment 2).

1.4 Regional and Site-Specific Geology

1.4.1 Regional Geology

Calhoun County includes parts of two physiographic provinces, the Piedmont Upland Province and the Valley and Ridge Province. The Piedmont Upland Province occupies the extreme eastern and southeastern portions of the county and is characterized by metamorphosed sedimentary rocks. The generally accepted range in age of these metamorphics is Cambrian to Devonian.

The majority of Calhoun County, including the Main Post of FTMC, lies within the Appalachian fold-and-thrust structural belt (Valley and Ridge Province), where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold-and-thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted, with major structures and faults striking in a northeast-southwest direction.

Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the imbricate stacking of large slabs of rock, referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault, resulting in imbricate stacking of rock units within the individual thrust sheet (Osborne and Szabo, 1984). Geologic contacts in this region generally strike parallel to the faults, and repetition of lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992) and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group consists of the Cochran, Nichols, Wilson Ridge, and Weisner Formations (Osborne and Szabo, 1984) but in Calhoun County is either undifferentiated or divided into the Cochran and Nichols Formations and an upper, undifferentiated Wilson Ridge and Weisner Formation. The Cochran is composed of poorly sorted arkosic sandstone and conglomerate with interbeds of greenish gray siltstone and mudstone. Massive to laminated greenish gray and black mudstone makes up the Nichols Formation, with thin interbeds of siltstone and very fine-grained sandstone (Osborne et al., 1988). These two formations are mapped only in the eastern part of the county.

The Wilson Ridge and Weisner Formations are undifferentiated in Calhoun County and consist of both coarse-grained and fine-grained clastics. The coarse-grained facies appears to dominate the unit and consists primarily of coarse-grained, vitreous quartzite and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consists of sandy and micaceous shale and silty, micaceous mudstone, which are locally interbedded with the coarse clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of FTMC belongs to the Weisner Formation (Osborne and Szabo, 1984).

The Cambrian Shady Dolomite overlies the Weisner Formation northeast, east, and southwest of the Main Post and consists of interlayered bluish gray or pale yellowish gray sandy dolomitic limestone and siliceous dolomite with coarsely crystalline, porous chert (Osborne et al., 1989). A variegated shale and clayey silt have been included within the lower part of the Shady Dolomite (Cloud, 1966). Material similar to this lower shale unit was noted in core holes drilled by the Alabama Geologic Survey on FTMC (Osborne and Szabo, 1984). The character of the Shady Dolomite in the FTMC vicinity and the true assignment of the shale at this stratigraphic interval are still uncertain (Osborne, 1999).

The Rome Formation overlies the Shady Dolomite and locally occurs to the northwest and southeast of the Main Post, as mapped by Warman and Causey (1962) and Osborne and Szabo (1984), and immediately to the west of Reilly Airfield (Osborne and Szabo, 1984). The Rome Formation consists of variegated, thinly interbedded grayish red-purple mudstone, shale, siltstone, and greenish red and light gray sandstone, with locally occurring limestone and dolomite. Weaver Cave, located approximately one mile west of the northwest boundary of the Main Post, is situated in gray dolomite and limestone mapped as the Rome Formation (Osborne et al., 1997). The Conasauga Formation overlies the Rome Formation and occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey, 1962; Osborne and Szabo, 1984) and the northern portion of the Main Post (Osborne et al., 1997). The Conasauga Formation is composed of dark gray, finely to coarsely crystalline, medium- to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in Calhoun County and consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weather to a chert residuum (Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone consists of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped as undifferentiated at FTMC and in other parts of Calhoun County. The Athens Shale overlies the Ordovician limestone units. The Athens Shale consists of dark gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989). These units occur within an eroded "window" in the uppermost structural thrust sheet at FTMC and underlie much of the developed area of the Main Post.

Other Ordovician-aged bedrock units mapped in Calhoun County include the Greensport Formation, Colvin Mountain Sandstone, and Sequatchie Formation. These units consist of various siltstones, sandstones, shales, dolomites, and limestones and are mapped as one, undifferentiated unit in some areas of Calhoun County. The only Silurian-age sedimentary formation mapped in Calhoun County is the Red Mountain Formation. This unit consists of interbedded red sandstone, siltstone, and shale with greenish gray to red silty and sandy limestone.

The Devonian Frog Mountain Sandstone consists of sandstone and quartzitic sandstone with shale interbeds, dolomudstone, and glauconitic limestone (Osborne et al., 1988). This unit locally occurs in the western portion of Pelham Range.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of dark to light gray limestone with abundant chert nodules and greenish gray to grayish red phosphatic shale, with increasing amounts of calcareous chert toward the upper portion of the formation (Osborne and Szabo, 1984). These units occur in the northwestern portion of Pelham Range. Overlying the Fort Payne Chert is the Floyd Shale, also of Mississippian age, which consists of thin-bedded, fissile, brown to black shale with thin intercalated limestone layers and interbedded sandstone. Osborne and Szabo (1984) reassigned the Floyd Shale, which was mapped by Warman and Causey (1962) on the Main Post of FTMC, to the Ordovician Athens Shale based on fossil data.

The Pennsylvanian Parkwood Formation overlies the Floyd Shale and consists of medium to dark gray, silty, clay shale and mudstone with interbedded light to medium gray, very fine to fine grained, argillaceous, micaceous sandstone. Locally the Parkwood Formation also contains beds of medium to dark gray argillaceous, bioclastic to cherty limestone and beds of clayey coal up to a few inches thick (Raymond et al., 1988). In Calhoun County, the Parkwood Formation is generally found within a structurally complex area known as the Coosa deformed belt. In the deformed belt, the Parkwood Formation and Floyd Shale are mapped as undifferentiated because their lithologic similarity and significant deformation make it impractical to map the contact (Thomas and Drahovzal, 1974; Osborne et al., 1988). The undifferentiated Parkwood Formation and Floyd Shale are found throughout the western quarter of Pelham Range.

The Jacksonville thrust fault is the most significant structural geologic feature in the vicinity of the Main Post of FTMC, both for its role in determining stratigraphic relationships in the area and for its contribution to regional water supplies. The trace of the fault extends northeastward for approximately 39 miles between Bynum, Alabama, and Piedmont, Alabama. The fault is interpreted as a major splay of the Pell City fault (Osborne and Szabo, 1984). The Ordovician sequence that makes up the Eden thrust sheet is exposed at FTMC through an eroded window, or "fenster," in the overlying thrust sheet. Rocks within the window display complex folding, with the folds being overturned and tight to isoclinal. The carbonates and shales locally exhibit well-developed cleavage (Osborne and Szabo, 1984). The FTMC window is framed on the northwest by the Rome Formation, north by the Conasauga Formation, northeast, east, and southwest by the Shady Dolomite, and southeast and southwest by the Chilhowee Group (Osborne et al., 1997). Two small klippen of the Shady Dolomite, bounded by the Jacksonville fault, have been recognized adjacent to the Pell City fault at the FTMC window (Osborne et al., 1997).

The Pell City fault serves as a fault contact between the bedrock within the FTMC window and the Rome and Conasauga Formations. The trace of the Pell City fault is also exposed approximately nine miles west of the FTMC window on Pelham Range, where it traverses northeast to southwest across the western quarter of Pelham Range. The trace of the Pell City fault marks the boundary between the Pell City thrust sheet and the Coosa deformed belt.

The eastern three-quarters of Pelham Range is located within the Pell City thrust sheet, while the remaining western quarter of Pelham is located within the Coosa deformed belt. The Pell City thrust sheet is a large-scale thrust sheet containing Cambrian and Ordovician rocks. It is relatively less structurally complex than the Coosa deformed belt (Thomas and Neathery, 1982). The Pell City thrust sheet is exposed between the traces of the Jacksonville and Pell City faults along the western boundary of the FTMC window and along the trace of the Pell City fault on Pelham Range (Thomas and Neathery, 1982; Osborne et al., 1988). The Coosa deformed belt is a narrow northeast-to-southwest-trending linear zone of complex structure (approximately 5 to 20 miles wide and approximately 90 miles in length) consisting mainly of thin imbricate thrust slices. The structure within these imbricate thrust slices is often internally complicated by small-scale folding and additional thrust faults (Thomas and Drahovzal, 1974).

1.4.2 Site-Specific Geology

The Anniston and Allen gravelly loam and the Jefferson gravelly fine sandy loam are mapped underlying the Training Area T-5 Sites. All of Parcels 180(7), 511(7), 512(7), 514(7), and 516(7) are underlain by the Anniston and Allen gravelly loam. Most of Parcels 182(7) and 513(7) are underlain by the Anniston and Allen gravelly loam, with the exception of the eastern portions of both parcels, which are underlain by the Jefferson gravelly fine sandy loam (U.S. Department of Agriculture [USDA], 1961).

The Anniston and Allen gravelly loam and the Jefferson gravelly fine sandy loam are typically developed in old alluvium found along the foot slopes and alluvial fans of the larger hills in the region. The color of the Anniston and Allen gravelly loam surface soil ranges from dark brown to reddish brown. The subsurface soil is generally a reddish brown and consists of a gravelly clay loam to clay or silty clay loam. The color of the Jefferson gravelly fine sandy loam surface soil ranges from dark grayish brown to gray. The subsurface soil ranges in color from light olive brown to strong brown to reddish yellow with some mottling (USDA, 1961).

Figure 1-3 shows that the Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7) and 516(7), are located along the southwest boundary of the FTMC geologic window discussed in Section 1.4.1 window. The undifferentiated Mississippian/Ordovician Floyd and Athens Shale is mapped beneath all of the Training Area T-5 Sites except in the southwestern half of Parcel 182(7). The Jacksonville fault is mapped across the central portion of Parcel 182(7), marking the fault contact between the undifferentiated Cambrian Chilhowee Group, which underlies the southwestern corner of the parcel, and the undifferentiated Mississippian/Ordovician Floyd and Athens Shale (Osborne et al., 1997).

Soil encountered during direct-push and drilling activities at the Training Area T-5 Sites consisted predominantly of a light brown to brown to reddish brown to yellowish orange clay with lesser amounts of sand, silt, and gravel. The descriptions of the soils encountered at the site are consistent with the mapped Anniston and Allen gravelly loam and the Jefferson gravelly fine sandy loam. Lithologic logs for direct-push borings are included in Appendix A.

Bedrock was encountered at six monitoring well locations during the SI hollow-stem and air rotary drilling activities at the Training Area T-5 Sites. White to light gray sandstone was encountered at CWM-182-MW01 at a depth of 18.0 feet below ground surface (bgs), and highly weathered, dark gray to black shale was encountered at CMW-513-MW01 and CWM-514-MW02 at depths of 31.5 and 58.0 feet bgs, respectively. The bedrock encountered at these locations is consistent with Osborne et al. (1997). White to gray limestone was encountered at CWM-180-MW02, CWM-182-MW05, and CWM-514-MW03 at depths of 41.2, 25.1, and 58.0 feet bgs, respectively. The limestone encountered at these locations does not appear consistent with Osborne et al. (1997). The proposed drilling and sampling activities during this RI will provide additional lithologic and structural information at the Training Area T-5 Sites. The lithologic logs for the monitoring well borings are included in Appendix A.

1.5 Regional and Site-Specific Hydrogeology

1.5.1 Regional Hydrogeology

The hydrogeology of Calhoun County has been investigated by the Geologic Survey of Alabama (Moser and DeJarnette, 1992) and the U.S. Geological Survey in cooperation with the General Services Administration (Warman and Causey, 1962) and Alabama Department of Environmental Management (ADEM) (Planert and Pritchette, 1989). Groundwater in the vicinity of FTMC occurs in residuum derived from bedrock decomposition, within fractured bedrock along fault zones, and from the development of karst frameworks. Groundwater flow may be estimated to be toward major surface water features. Groundwater flow in areas with well-developed residuum horizons may subtly reflect the surface topography, but the groundwater flow direction also may exhibit the influence of pre-existing structural fabrics or the presence of perched water horizons on unweathered ledges or impermeable clay lenses.

Precipitation and subsequent infiltration provide recharge to the groundwater flow system in the region. The main recharge areas for the aquifers in Calhoun County are located in the valleys. The ridges generally consist of sandstone, quartzite, and slate, which are resistant to weathering, relatively unaffected by faulting, and therefore, relatively impermeable. The ridges have steep slopes and thin to no soil cover, which enhances runoff to the edges of the valleys (Planert and Pritchette 1989).

The thrust fault zones typical of the county form large storage reservoirs for groundwater. Points of discharge occur as springs, effluent streams, and lakes. Coldwater Spring is one of the largest springs in the State of Alabama, with a discharge of approximately 32 million gallons per day. This spring is the main source of water for the Anniston Water Department, from which FTMC buys its water. The spring is located approximately five miles southwest of Anniston and discharges from the brecciated zone of the Jacksonville fault (Warman and Causey, 1962).

Shallow groundwater on FTMC occurs principally in the residuum developed from Cambrian sedimentary and carbonate bedrock units of the Weisner Formation, Shady Dolomite and locally in lower Ordovician carbonates. The residuum may yield adequate groundwater for domestic and livestock needs but may go dry during prolonged dry weather. Bedrock permeability is locally enhanced by fracture zones associated with thrust faults and by the development of solution (karst) features.

Two major aquifers were identified by Planert and Pritchette (1989): the Knox-Shady and Tuscumbia-Fort Payne aquifers. The continuity of the aquifers has been disrupted by the complex geologic structure of the region, such that each major aquifer occurs repeatedly in different areas. The Knox-Shady aquifer group occurs over most of Calhoun County and is the main source of groundwater in the county. It consists of the Cambrian- and Ordovician-aged quartzite and carbonates. The Conasauga Dolomite is the most utilized unit of the Knox-Shady aquifer, with twice as many wells drilled as any other unit (Moser and DeJarnette, 1992).

Regional groundwater flow in the bedrock was approximated for the FTMC vicinity by the U.S. Geological Survey (Scott et al., 1987). Regional groundwater elevation ranged from 800 feet above mean sea level on the main Base to about 600 feet above mean sea level to the west on Pelham Range, based on water depths in wells completed across multiple formations. Groundwater elevation contours seem to suggest that regional groundwater flow is from the Main Post towards the northwest. Scott et al. (1987) concluded that the groundwater surface broadly coincides with the surface topography and that the regional aquifers are hydraulically connected. Groundwater flow on a local scale may be more complex and may be affected by geologic structures such as the shallow thrust faults, rock fracture systems, and karst development in soluble formations.

1.5.2 Site-Specific Hydrogeology

Static groundwater levels were measured in the permanent monitoring wells at Training Area T-5 Sites and adjacent wells from Parcels 97(7) and 232QX on January 7 and 8, 2002. Depth to groundwater measurements were taken from the top of casing following procedures outlined in the SAP (IT, 2002a). A potentiometric surface map (Figure 1-4) was constructed for the residuum water-bearing zone at the Training Area T-5 Sites. As shown on Figure 1-4, groundwater flow has a net flow direction of south to north across this area. The hydraulic gradient decreases from south to north across the area and, based on the January 2002, data the horizontal hydraulic gradient ranges from less than 0.03 foot per foot (ft/ft) to 0.15 ft/ft, with an arithmetic mean of approximately 0.07 ft/ft (Table 1-1).

As shown on Figure 1-4 there are large variations in the residuum groundwater levels in the northwest portion of the site in the area of Parcel 514(7). The largest variations in water levels occur between the monitoring wells located Parcel 514(7) (21.39 feet between CWM-514-MW02 and CWM-514-MW03) and monitoring wells HR-232QX-MW04 and HR-232QX-MW19 (54.48 feet).

The significant variation in water levels at Parcel 514(7) is most likely related to the water-bearing zones in which the wells are screened. Evidence for the two different water-bearing zones comes from differences observed between the depth groundwater was encountered during drilling and static water levels measured in CWM-514-MW01, CWM-514-MW02, and CWM-514-MW03. Groundwater elevation variations at Parcel 180(7) may be due to the presence of a perched water-bearing zone observed at CWM-180-MW03. The proposed drilling and water level collecting during this RI will provide additional hydrogeological information at the Training Area T-5 Sites.

1.6 Scope of Work

The scope of work for activities associated with the RI for Training Area T-5 Sites includes the following tasks:

- Develop the RI SFSP attachment.

- Develop the RI SSHP attachment.

- Develop the UXO safety plan attachment.

- Conduct a surface and near-surface UXO survey over all areas to be included in the sampling effort.

- Provide downhole UXO support for all intrusive direct-push and drilling activity to determine the presence of potential downhole hazards.

- Install 22 groundwater monitoring wells (11 residuum and 11 bedrock monitoring wells).

- Collect 48 groundwater samples (22 proposed wells and 26 pre-existing wells), 11 surface soil samples, 11 subsurface soil samples, 10 depositional soil samples, 1 surface water sample, and 1 sediment sample.

- Analyze samples for the parameters listed in Section 4.6.

- Conduct slug tests on selected monitoring wells (three bedrock and three residuum wells.

- Conduct a feasibility study (FS) in accordance with the guidelines, criteria, and considerations set forth in the U.S. Environmental Protection Agency (EPA) 1988 guidance document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final.*

USACE-Huntsville requires that work conducted at potential CWM sites use UXO anomaly avoidance techniques. Therefore, prior to initiating field activities at Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7), IT will conduct UXO avoidance activities as outlined in Appendix E of the SAP and the attached site-specific UXO safety plan. Surface sweeps and downhole surveys will be conducted to identify anomalies for the purpose of UXO avoidance.

At the completion of the field activities and sample analyses, draft, draft final, and final RI summary reports will be prepared in accordance with current EPA Region 4 and ADEM requirements.

Subsequent to completion of the RI field work, an FS will be conducted for Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7). The FS will identify, develop, screen, and evaluate remedial alternatives for contaminated media at the site, as required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and as specified in the National Oil and Hazardous Substances Contingency Plan (40 *Code of Federal Regulations*, Part 300). An FS report will be prepared in accordance with the guidelines, criteria, and considerations set forth in the EPA guidance document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA, 1988). The report will provide the Base Realignment and Closure (BRAC) Cleanup Team with sufficient data to select a feasible and cost-effective remedial alternative that will protect human health and the environment.

The sections in the FS report will provide the following:

- An introduction detailing site background information and a summary of the RI, including the nature and extent of contamination, contaminant fate and transport, and the results of the human health and ecological risk assessments

- Identification and screening of remedial technologies

- Development and screening of remedial alternatives

- A detailed analysis of remedial alternatives.

The section of the report dealing with identification and screening of technologies will present objectives for remedial action(s), a summary of applicable health and environmental protection criteria and standards, and identification of volumes or areas of media to which remedial actions may be applied. It will also identify general response actions for each medium of interest, defining containment, treatment, excavation, or other actions that may be taken, singularly or in combination, to satisfy the remedial action objectives. Potentially feasible technologies will be presented for each of the general response actions, along with the technical criteria and the site-specific requirements used in the technology screening process, and the results of the remedial technology screening.

The section of the FS report on development and screening of remedial alternatives will present the remedial alternatives developed by combining the technologies carried forward from the initial screening. Each of the identified alternatives will be screened against three evaluation criteria: 1) effectiveness, 2) implementability, and 3) cost.

The detailed analysis of remedial alternatives section will present a description and evaluation of each of the alternatives retained from the screening of alternatives. Each alternative will be evaluated individually, and a comparative analysis among alternatives will be presented. The remedial action alternatives selected for evaluation will be individually evaluated against the following seven criteria:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume
- Short-term effectiveness
- Implementability
- Cost.

Although CERCLA requires the evaluation of alternatives against nine evaluation criteria, the state acceptance and community acceptance criteria will be evaluated in the record of decision after comments have been received on the FS report from the regulatory agencies and the public.

2.0 Summary of Existing Environmental Studies

An EBS was conducted by ESE to document current environmental conditions of all FTMC property (ESE, 1998). The study was to identify sites that, based on available information, have no history of contamination and comply with U.S. Department of Defense guidance for fast-track cleanup at closing installations. The EBS also provides a baseline picture of FTMC properties by identifying and categorizing the properties by seven criteria.

1. Areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas)

2. Areas where only release or disposal of petroleum products has occurred

3. Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial response

4. Areas where release, disposal, and/or migration of hazardous substances has occurred, and all removal or remedial actions to protect human health and the environment have been taken

5. Areas where release, disposal, and/or migration of hazardous substances has occurred, and removal or remedial actions are underway, but all required remedial actions have not yet been taken

6. Areas where release, disposal, and/or migration of hazardous substances has occurred, but required actions have not yet been implemented

7. Areas that are not evaluated or require additional evaluation.

The EBS was conducted in accordance with the Community Environmental Response Facilitation Act (CERFA) protocols (CERFA-Public Law 102-426) and U.S. Department of Defense policy regarding contamination assessment. Record searches and reviews were performed on all reasonably available documents from FTMC, ADEM, EPA Region 4, and Calhoun County, as well as a database search of substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act; petroleum products; and facilities regulated under the Resource Conservation and Recovery Act. Available historical maps and aerial photographs were reviewed to document historical land uses. Personal and telephone interviews of past and present FTMC employees and military personnel were conducted. In addition, visual site inspections were conducted to verify conditions of specific property parcels.

Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7) were classified as Category 7 CERFA sites. Category 7 CERFA parcels are areas that have not been evaluated or that require additional evaluation to determine their environmental condition.

Section 2.1 provides an overview of previous investigations conducted at the Training Area T-5 Sites prior to the investigation undertaken by IT in 2001 and 2002. The results of the SI conducted by IT are discussed in Section 2.2.

2.1 Previous Investigations

2.1.1 Former Detection and Identification Area, Parcel 180(7)

The Former Detection and Identification Area, Parcel 180(7), is an approximately one-half-acre site that was used from the 1950s to 1973 for Sarin (GB) and possibly distilled mustard (HD) training. Agent simulants, carbonyl chloride, cyanogen chloride, dichloroformoxine, and hydrogen cyanide also may have been used in training. The training aids (i.e., structures) from this site and a building were burned and buried at the Former Detection and Identification Area. The burial pit is identified on Figure 2-1 as Monument "F."

Science Applications International Corporation (SAIC) conducted SI and RI activities at the Former Detection and Identification Area in 1993 and 1995, respectively. These investigations were focused exclusively on CWM. The SI included the collection of four soil samples from two sample locations at depths of approximately one and six feet bgs. One soil sample was collected within the burial pit, and the other sample was collected from the area where the materials were burned (Figure 2-1). The soil samples were field screened for HD and GB agents by U.S. Army Technical Escort Unit (USATEU) using Miniature Continuous Air Monitoring System (MINICAMS) prior to shipment to the laboratory for analysis. The samples were analyzed for HD and GB breakdown products. All screening results were below background, and the analytical results did not indicate the presence of breakdown products in the soil samples (SAIC, 1993).

The RI included a geophysical survey which implemented an EM31 and magnetometer in order to delineate the burial pit in the vicinity of Monument F. Data were recorded along four transects intersecting at Monument F. Four trenches were excavated by USATEU within the former Detection and Identification Area based on the geophysical survey results (Figure 2-1). Excavated materials from the trenching activities included concrete rubble with rebar, wood, sand, and tar paper. Training-related materials that were excavated at the site consisted of glass tube fragments (potentially from an M-18 test kit) and a rubber (chemical) glove. One soil sample was collected from each of the trenches, screened with MINICAMS by USATEU for HD, GB, and VX agents and were sent to the laboratory for analysis of breakdown products. All screening results were below background, and the analytical results did not indicate the presence of breakdown products in the soil samples (SAIC, 2000).

Parsons conducted an EE/CA at 33 sites, including the Former Detection and Identification Area, Parcel 180(7), to evaluate potential CWM contamination (Parsons, 2002). Based on historical information and existing analytical data from previous investigations (SAIC, 1993 and 2000), Parsons determined the risk of exposure to CWM at Parcel 180(7) is unlikely. Hence, Parsons (2002) recommended a "no further action" response alternative related to CWM at the Former Detection and Identification Area, Parcel 180(7).

2.1.2 Training Area T-5, Parcel 182(7)

Training Area T-5, Parcel 182(7), consists of a wooded, approximately 10.5-acre site that included kennels for canine units (Figure 2-2). The Dog Kennel Area has been separated from Training Area T-5 and has been assigned a separate parcel number (516[7]). Training Area T-5 was used for chemical agent training between 1961 and 1973 using GB, HD, and VX. The training sites were reportedly decontaminated after each exercise using STB and DS2 (SAIC, 2000). Evidence of ordnance was observed on the site in March 1992 (SAIC, 1993). However, further investigation indicated that the ordnance consisted of dummy rounds that were most likely used in recent training (after 1973) by the Army (Parsons, 2002).

SAIC completed SI and RI activities at Training Area T-5 in 1993 and 1995, respectively. These investigations were focused exclusively on CWM. The SI included the collection of four soil samples at two locations at depths of approximately one foot and five feet bgs and collection of one surface water and sediment sample (Figure 2-2). The soil samples were field screened for GB, HD, and VX agents by USATEU using MINICAMS prior to shipping the samples to the laboratory for analysis. The soil samples were analyzed for GB, HD, and VX breakdown products. All screening results were below background, and the analytical results did not indicate the presence of breakdown products in the samples (SAIC, 1993).

The RI included the collection of 44 surface soil screening samples, four surface soil samples, and two surface water and sediment samples (Figure 2-2). Sample locations were based on historical documentation, which included training location sketches and photographs of training activities. The samples were field screened for GB, HD, and VX by USATEU using MINICAMS and were laboratory analyzed for their respective breakdown products. All screening results were below background, and the analytical results did not indicate the presence of breakdown products in the samples (SAIC, 2000).

Parsons conducted an EE/CA at 33 sites, including Training Area T-5, Parcel 182(7), to evaluate potential CWM contamination (Parsons, 2002). Based on historical information and existing analytical data from previous investigations (SAIC, 1993 and 2000), Parsons determined the risk of exposure to CWM at Parcel 182(7) is unlikely. Hence, Parsons recommended a "no further action" response alternative related to CWM at Training Area T-5, Parcel 182(7).

2.1.3 Blacktop Training Area, Parcel 511(7), and Fenced Yard in Blacktop Area, Parcel 512(7)

Parcels 511(7) and 512(7) consist of a three-acre asphalt area located at the corner of Justice Avenue and Reggie Avenue (Figure 2-3). Bleachers are located on the north and south ends of the paved area. Historically, the blacktop area contained a fenced yard; however, the fence was removed at an unknown date and only parts of the fence posts remain.

Parsons conducted an EE/CA at 33 FTMC sites, including the Blacktop Training Area, Parcel 511(7), and the Fenced Yard in Blacktop Area, Parcel 512(7), to evaluate potential CWM contamination (Parsons, 2002). The investigation at Parcels 511(7) and 512(7) consisted of soil sampling and qualitative risk evaluations.

Thirty-six soil samples were collected from 18 hand-auger borings advanced below the blacktop at Parcels 511(7) and 512(7). Soil sample locations were randomly selected over the sites (Figure 2-3). Soil samples were collected from each boring at depths of 0.5 to 1 foot bgs and 3.5 to 4.0 feet bgs. During soil sampling activities, continuous air monitoring was performed using MINICAMS, Open-Path Fourier Transform Infrared Spectroscoy (OPFTIR), and photoionization detector (PID) (Parsons, 2002).

The soil samples were field screened for GB and HD agents by Edgewood Chemical/Biological Command (ECBC) prior to shipping the samples to its laboratory. The samples were analyzed for GB and HD breakdown products. All screening results were below background, and the analytical results did not indicate the presence of GB and HB breakdown products above reporting limits (Parsons, 2002).

The soil analytical results collected during the investigation suggest that no residual agents or breakdown products exist in the sampled media. In addition, historical records provide no indication of sources of CWM in the environment at Parcels 511(7) and 512(7). Therefore, the probability of current or future risk of human exposure to chemical agents is very small (Parsons, 2002). Hence, Parsons recommended a "no further action" response alternative related to CWM at the Blacktop Training Area, Parcel 511(7), and the Fenced Yard in Blacktop Area, Parcel 512(7).

2.1.4 Dog Training Area, Parcel 513(7)

The Dog Training Area, Parcel 513(7), is located at the south end of Reggie Avenue near the Dog Kennel Areas (Figure 2-4). The site was used for training dogs for the military police school. A large blistered and corroded concrete pad, which was surrounded by a high fence, is located within the area and may have been used to store agents or to conduct agent training in "Transfer Operations" (USACE, 2001).

Parsons conducted an EE/CA at 33 FTMC sites, including the Dog Training Area, Parcel 513(7), to evaluate potential CWM contamination. The EE/CA investigation at Parcel 513(7) consisted of soil sampling and a qualitative risk evaluation.

Four soil samples were collected from two hand-auger borings advanced adjacent to the blistered and corroded concrete pad at Parcel 513(7) (Figure 2-4). Two soil samples were collected from each boring at depths of 0.5 to 1 foot bgs and 3.5 to 4.0 feet bgs. During soil sampling activities, continuous air monitoring was performed using MINICAMS, OPFTIR, and PID (Parsons, 2002).

The soil samples were field screened for GB and HD agents by ECBC prior to shipping the samples to ECBC's laboratory. The samples were analyzed for GB and HD breakdown products. All screening results were below background, and the analytical results did not indicate the presence of breakdown products above reporting limits (Parsons, 2002).

The soil analytical results collected during the investigation suggest that no residual agents or breakdown products exist in the sampled media. In addition, historical records provide no indication of sources of CWM in the environment at Parcel 513(7). Therefore, the probability of current or future risk to human exposure to chemical agents is very small (Parsons, 2002). Hence, Parsons recommended a "no further action" response alternative related to CWM at the Dog Training Area, Parcel 513(7).

2.1.5 Old Burn Pit, Parcel 514(7)

The Old Burn Pit, Parcel 514(7), is located in the wooded area southwest of Motor Pool Area 3100 (Figure 2-5). The site was identified for consideration by the ASR, although there is no documentation or other information indicating that chemical training was performed at the site

(USACE, 2001). This area was selected for further investigation because it appeared to have been a burn pit and was in the general vicinity of other CWM training sites.

The Old Burn Pit, Parcel 514(7), was among 33 FTMC sites included in an EE/CA conducted by Parsons to evaluate potential CWM contamination (Parsons, 2002). The EE/CA investigation at Parcel 514(7) consisted of intrusive investigation and a qualitative risk evaluation. Three depressions near the Old Burn Pit were investigated using hand tools. During the excavation activities, continuous air monitoring was performed using MINCAMS, OPFTIR, and PID. The approximate locations of the three excavated areas (Areas 1, 2, and 3) are shown on Figure 2-5. Area 1 contained multiple inert and practice OE items in addition to metallic debris. Area 2 contained a steel box with cans, wire-wrapped cans, plate glass, and a dummy grenade. Area 3 contained flakes of rust and jar lids. No evidence was encountered (e.g., charred wood) to suggest that these pits were ever used for burning (Parsons, 2002).

Although some OE items were found in one of the excavated areas at the site, no CWM was encountered. Based on the results of the EE/CA investigation, it was concluded that there are no sources of CWM in the environment at the Old Burn Pit. Therefore, the probability of current or future risk of human exposure to chemical agents is very small (Parsons, 2002). Hence, Parsons recommended a "no further action" response alternative related to CWM at the Old Burn Pit, Parcel 514(7).

2.1.6 Dog Kennel Area, Parcel 516(7)

The Dog Kennel Area, Parcel 516(7), is located at the south end of Reggie Avenue, across the street from the Dog Training Area, Parcel, 513(7) (Figure 2-4). The Dog Kennel Area was identified in the ASR as having a possible storage area in the inner yard that could have been used for toxic agents (USACE, 2001). The Dog Kennel Area is shown on the 1969 Chemical School Orientation Map as part of Training Area T-5. Mustard confidence training, which used drops of mustard, may have taken place within the Quonset hut located inside the perimeter fence (USACE, 2001). However, aerial photographs did not indicate the likelihood of disposal within these areas (Parsons, 2002).

Parsons conducted an EE/CA at 33 sites, including the Dog Kennel Area, Parcel 516(7), to evaluate potential CWM contamination (Parsons, 2002). Based on historical information, small quantities of HD may have been used at this site. However, HD usage would have occurred within the confines of the structure in the fenced area (Parsons, 2002). A site visit by Parsons found no evidence of a burial pit at the site. The likelihood of minute quantities of HD persisting in the environment for a long period is low. Therefore, the probability of current or future risk of human exposure to chemical agents is very small (Parsons, 2002). Hence, Parsons recommended a "no further action" response alternative related to CWM at the Dog Kennel Area, Parcel 516(7).

2.1.7 Summary

Based on a historical review and sampling and analysis activities performed during the CWM EE/CA investigation, along with other types of investigations, Parsons indicated that it can be inferred that no residential CWM or degradation products exist in the sampled media. Therefore, the probability of current and future human health risk due to exposure to CWM is very unlikely. A "no further action" alternative is recommended by Parsons for the Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7). As a result of the CWM EE/CA investigation by Parsons, USACE-Huntsville Center issued a release of CWM sites on the Main Post to conduct HTRW investigations (Attachment 2).

2.2 Site Investigation

IT conducted SI activities at eleven CWM sites, including the Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7) at FTMC, Calhoun County, Alabama. The purpose of the SI was to determine the presence or absence of PSSCs and recommend further actions, if appropriate. The following sections summarize the SI activities conducted by IT at the Training Area T-5 Sites.

2.2.1 Summary of Field Activities

The SI activities conducted by IT at the Training Area T-5 Sites consisted of collection and analysis of 29 surface and depositional soil samples, 21 subsurface soil samples, 21 groundwater samples, and 2 surface water and sediment samples. In addition, 21 monitoring wells were installed to facilitate collection of the groundwater samples and to provide site-specific geological and hydrogeological characterization information.

Samples collected during the SI at Training Area T-5 Sites were analyzed for the following:

- Target analyte list metals – EPA Methods 6010B/7471A
- Target compound list volatile organic compounds (VOC) – EPA Method 8260B
- Target compound list semivolatile organic compound (SVOC) – EPA Method 8270C
- CWM breakdown products (including orthosulfur compounds) – EPA Methods 8321 and 8270M.

Sediment samples were analyzed for the following additional parameters:

- Total organic carbon (TOC) – EPA Method 9060

- Grain size – American Society for Testing and Materials (ASTM) Method D421/D422.

The samples were analyzed using EPA SW-846 methods, including Update III methods where applicable, as presented in the SAP (IT, 2000a). Sample locations are shown on Figure 2-6. Sample locations, media, and rationale are summarized in Table 2-1. Sample collection logs are included in Appendix B.

Environmental sampling at the Training Area T-5 Sites was performed following procedures outlined in the SI SFSP (IT, 2000a) and in conjunction with the SSHP as attachments to the installation-wide work plan (IT, 1998) and the installation-wide SAP (IT, 2000b). The monitoring wells were installed and developed as described in the SAP. Table 2-2 summarizes construction details of the monitoring wells installed at the site. The lithological logs and well construction logs are included in Appendix A. Well development logs are included in Appendix C. Table 2-3 summarizes the groundwater and surface water quality parameters.

Sample locations were surveyed using global positioning system (GPS) and conventional civil survey techniques described in the SAP (IT, 2000a). Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix D.

Three variances to the SFSP were recorded during the completion of the SI at the Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7). These variances did not alter the intent of the investigation or the sampling rationale presented in the SFSP (IT, 2000a). The variances to the SFSP are summarized in Table 2-4, and the variance reports are included in Appendix E.

2.2.2 Summary of Analytical Results

The results of the chemical analyses of samples collected at the Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7) indicate that metals, VOCs, and SVOCs were detected in the various site media. To evaluate the nature and extent of contamination at the site, the analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for FTMC. The SSSLs and ESVs were developed by IT as part of the human health and ecological risk evaluations associated with SIs being performed under the BRAC Environmental Restoration Program at FTMC. The SSSLs, ESVs, and polynuclear aromatic hydrocarbon (PAH) background screening values are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000c). The PAH background screening values were developed by IT at the direction of the BRAC Cleanup Team to address the occurrence of PAH compounds in surface soils as a result of anthropogenic activities at FTMC. Background metals screening values are presented in the *Final Background Metals Survey Report, Fort McClellan, Alabama* (SAIC, 1998). Summary statistics for background metal samples collected at FTMC are included in Appendix F.

The following sections and Tables 2-5 through 2-9 summarize the results of the comparison of the detected constituents to the SSSLs, ESVs, and background screening values. Complete analytical data are presented in Appendix G.

2.2.2.1 Surface and Depositional Soil Analytical Results

Twenty-one surface soil and eight depositional soil samples were collected at the Training Area T-5 Sites. Surface and depositional soil samples were collected from the uppermost foot of soil at the locations shown on Figure 2-6. Analytical results were compared to residential human health SSSLs, ESVs, and metals background screening values (metals and PAHs), as presented in Table 2-5.

Metals. Twenty-two metals were detected in surface and depositional soil samples collected at the Training Area T-5 Sites. The concentrations of the following seven metals exceeded SSSLs and their respective background concentrations in one or more samples: aluminum, antimony, arsenic, chromium, iron, manganese, and vanadium. Of these metals, only one iron result at CWM-180-MW03 and one antimony result at CWM-514-MW03 exceeded their respective upper background ranges (UBR) (Appendix F). However, the antimony result was flagged with a "B" data qualifier, signifying this metal was also detected in an associated laboratory or field blank sample.

Sixteen metals were detected at concentrations exceeding ESVs and their respective background concentrations in one or more samples: aluminum, antimony arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, vanadium, and zinc. However, only antimony (CWM-514-MW01), barium (CWM-516-MW02), beryllium (four samples), cadmium (three samples), copper (three samples), iron (CWM-180-MW03), nickel (CWM-182-MW04), and zinc (CWM-182-DEP03) results exceeded their respective UBRs. Figure 2-7 shows the sample locations with metals results exceeding SSSLs, ESVs and UBRs.

Volatile Organic Compounds. Ten VOCs were detected in surface and depositional soil samples collected at the Training Area T-5 Sites. Three acetone results, 13 methylene chloride results, and three tricholorofluoromethane results were flagged with a "B" data qualifier, signifying that these compounds were also detected in an associated laboratory or field blank sample. A majority of the remaining VOC results were flagged with a "J" data qualifier, indicating that the concentrations were estimated. VOC concentrations in the surface and depositional soil samples ranged from 0.00096 to 0.66 milligrams per kilogram (mg/kg) and were below SSSLs and ESVs. Figures 2-8 through 2-10 show the sample locations with VOCs detected in surface and depositional soil.

Semivolatile Organic Compounds. A total of 13 SVOCs (all PAH compounds) were detected in 5 of the 29 surface and depositional soil samples collected at the Training Area T-5 Sites. The PAHs were detected at four sample locations at Parcel 511(7) and one sample location at Parcel 513(7). A majority of the PAH results were flagged with a "J" data qualifier, indicating that the concentrations were estimated. SVOC concentrations in the surface and depositional soil samples ranged from 0.0062 to 0.95 mg/kg.

Two PAH compounds, benzo(a)pyrene (four sample locations) and dibenz(a,h)anthracene (CWM-511-MW03), were detected at concentrations exceeding SSSLs. However, the concentrations were below the respective PAH background screening values.

Four PAH compounds (benzo[a]pyrene, fluoranthene, phenanthrene, and pyrene) were detected at concentrations exceeding ESVs. The concentrations of these PAHs, however, were all below their respective PAH background screening values. Figure 2-11 shows the sample locations with SVOCs exceeding SSSLs and ESVs. As shown on the figure, the sample locations with elevated PAHs are in and around asphalt pavement, which is the likely source of these compounds.

CWM Breakdown Products. CWM breakdown products were not detected in the surface and depositional soil samples collected at the site.

2.2.2.2 Subsurface Soil Analytical Results

Twenty-one subsurface soil samples were collected at the Training Area T-5 Sites, as shown on Figure 2-6. Analytical results were compared to residential human health SSSLs and metals background concentrations, as presented in Table 2-6.

Metals. Twenty-one metals were detected in subsurface soil samples collected at the Training Area T-5 Sites. The concentrations of eight metals (aluminum, antimony, arsenic, barium, chromium, iron, manganese, and vanadium) exceeded SSSLs and their respective background concentrations in one or more samples. Of these metals, only aluminum (five samples), antimony (CWM-180-MW01 and CWM-180-MW03), and iron (CWM-180-MW03 and CWM-514-MW02) results exceeded their respective UBRs (Appendix F). Figure 2-12 shows the sample locations with metals results exceeding SSSLs and the UBR.

Volatile Organic Compounds. Seven VOCs were detected in subsurface soil samples collected at the site. Two acetone results, the methylene chloride results, and one of the trichlorofluoromethane results were flagged with a "B" data qualifier, signifying that these compounds were also detected in an associated laboratory or field blank sample. A majority of the remaining VOC results were flagged with a "J" data qualifier, indicating that the concentrations were estimated. VOC concentrations in the subsurface soil samples ranged from 0.0012 to 0.23 mg/kg and were below SSSLs. Figures 2-13 and 2-14 show the sample locations with VOCs detected in subsurface soils.

Semivolatile Organic Compounds. A total of four SVOCs (benzo[a]pyrene, benzo[b]fluoranthene, fluoranthene, and pyrene), all of which are PAH compounds, were detected in three of the 21 subsurface soil samples collected at the Training Area T-5 Sites. The PAHs were detected at two sample locations (CWM-511-MW01 and CWM-511-MW03) at Parcel 511(7) and at one sample location (CWM-512-MW01) at Parcel 512(7). All of the PAH results were flagged with a "J" data qualifier, indicating that the concentrations were estimated. SVOC concentrations in the subsurface soil samples ranged from 0.061 to 0.22 mg/kg.

Benzo(a)pyrene (0.22 and 0.17 mg/kg) exceeded its SSSL (0.085 mg/kg) at two subsurface sample locations (CWM-511-MW01 and CWM-511-MW03) (Figure 2-11).

CWM Breakdown Products. CWM breakdown products were not detected in the subsurface soil samples collected at the site.

2.2.2.3 Groundwater Analytical Results

Twenty-one groundwater samples were collected for chemical analysis at the Training Area T-5 Sites, at the locations shown on Figure 2-6. Analytical results were compared to residential human health SSSLs and metals background screening values, as presented in Table 2-7.

Metals. Nineteen metals were detected in groundwater samples collected at the Training Area T-5 Sites. The concentrations of eight metals (aluminum, arsenic, barium, chromium, iron, manganese, nickel, and thallium) exceeded SSSLs. Of these metals, aluminum, barium, iron, manganese, and thallium exceeded their respective background concentrations in one or more samples. (Note: background values were not available for chromium and nickel). With the exception of barium in one sample (CWM-182-MW03) and thallium in two samples (CWM-180-MW01 and CWM-511-MW02), the concentrations of these metals were within their respective UBRs (Appendix F). However, the thallium results were flagged with a "B" data qualifier, signifying that thallium was also detected in an associated laboratory or field blank sample.

Volatile Organic Compounds. Ten VOCs were detected in groundwater samples. Three chloroform results and all but of the one methylene chloride results were flagged with a "B" data qualifier, signifying that these compounds were also detected in an associated laboratory or field blank sample. VOC concentrations in groundwater samples ranged from 0.00022 to 5.5 milligrams per liter (mg/L). The concentrations of seven VOCs exceeded their respective SSSLs:

- 1,1,2,2-Tetrachloroethane (0.0016 to 0.29 mg/L) in five wells
- 1,1,2 -Trichloroethane (0.001 mg/L) in one well (CWM-514-MW03)
- Acetone (1.8 to 5.5 mg/L) in four wells
- Carbon tetrachloride (0.00087 and 0.037 mg/L) in two wells (CWM-182-MW02 and CWM-182-MW03)
- Chloroform (0.0012 to 0.0086 mg/L) in ten wells
- Tetrachloroethene (0.0018 mg/L) in one well (CWM-514-MW03)
- Trichloroethene (0.012 to 0.1 mg/L) in three wells (CWM-180-MW04, CWM-512-MW01, and CWM-514-MW03).

Figure 2-15 shows the sample locations with VOCs detected in groundwater. Figure 2-16 is an isopleth map showing the horizontal extent of chlorinated VOCs in groundwater.

Semivolatile Organic Compounds. One SVOC (bis[2-ethylhexyl]phthalate) was detected in three groundwater samples (CWM-182-MW04, CWM-514-MW01, and CWM-514-MW03). The detections (0.12, 0.077, and 0.045 mg/L, respectively) exceeded the SSSL (0.0043 mg/L) in all three samples. bis(2-Ethylhexyl)phthalate, however, is a common sample contaminant.

CWM Breakdown Products. CWM breakdown products were not detected in the groundwater samples collected at the site.

2.2.2.4 Surface Water Analytical Results

Two surface water samples were collected for chemical analysis at the Training Area T-5 Sites, as shown on Figure 2-6. Analytical results were compared to recreational site user human health SSSLs, ESVs, and metals background concentrations, as presented in Table 2-8.

Metals. Eight metals were detected in surface water samples collected at the site. The metals concentrations in the samples were below SSSLs. The aluminum and barium results at CWM-182-SW/SD01 and the barium, magnesium, and mercury results at CWM-511-SW/SD03 exceeded ESVs. With the exception of mercury, these metal results were below their respective background concentrations. No background value was available for mercury in surface water.

Volatile Organic Compounds. Two VOCs (acetone and methylene chloride) were detected in one surface water sample (CWM-182-SW/SD01). The methylene chloride result was flagged with a "B" data qualifier, signifying that this compound was also detected in an associated laboratory or field blank sample. The acetone result was flagged with a "J" data qualifier, indicating that the concentration was estimated.

The VOC concentrations in the surface water sample were below SSSLs and ESVs.

Semivolatile Organic Compounds. SVOCs were not detected in the surface water samples collected at the site.

CWM Breakdown Products. CWM breakdown products were not detected in the surface water samples collected at the site.

2.2.2.5 Sediment Analytical Results

Two sediment samples were collected for chemical and physical analyses at the site, as shown on Figure 2-6. Analytical results were compared to recreational site user human health SSSLs, ESVs, and metals background concentrations, as presented in Table 2-9.

Metals. Seventeen metals were detected in sediment samples collected at the site. Metals concentrations in the samples were below SSSLs. Only the copper result (28.4 mg/kg) at CWM-182-SW/SD01 marginally exceeded its ESV (18.7 mg/kg) and background concentration (17.1 mg/kg). However, the copper result was within the UBR (Appendix F).

Volatile Organic Compounds. One VOC (acetone) was detected in both sediment samples. The acetone result at CWM-511-SW/SD03 was flagged with a "B" data qualifier, signifying that this compound was also detected in an associated laboratory or field blank sample. The acetone result at CWM-182-SW/SD01 was flagged with a "J" data qualifier, indicating that concentration was estimated. The concentrations of acetone at CWM-182-SW/SD01 and CWM-511-SW/SD03 were 0.01 and 0.042 mg/kg, respectively, and were below the SSSL and ESV.

Semivolatile Organic Compounds. Nine SVOCs, (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[ghi]perylene, benzo[k]fluoranthene, chrysene, fluoranthene, indeno[1,2,3-cd]pyrene, and pyrene), all of which are PAH compounds, were detected in one sediment sample (CWM-511-SW/SD03). The SVOC results were flagged with a "J" data qualifier, indicating that concentrations were estimated.

The concentrations of SVOCs in the sediment sample were below SSSLs and ESVs.

CWM Breakdown Products. CWM breakdown products were not detected in the sediment samples collected at the site.

Total Organic Carbon and Grain Size. The sediment samples were analyzed for TOC and grain size. TOC concentrations were 16.2 and 22.5 mg/kg. The TOC and grain size results are summarized in Appendix G.

2.2.3 SI Summary and Conclusions

Comparison of the analytical data to the SSSLs, ESVs, and background screening values indicates that chemicals of potential concern are metals (in soils and groundwater), VOCs (groundwater), and SVOCs (in soils and groundwater) at the Training Area T-5 Sites. However, PAHs in soils are attributable to the presence of asphalt pavement and bis(2-Ethylhexyl)phthalate is a common sample contaminant and, therefore, are not considered as site related. Three metals in soils (aluminum, antimony, and iron) exceeded their respective SSSLs and UBRs in a limited number of samples. In groundwater, only one metal (barium) exceeded its SSSL and UBR in one sample. Seven VOCs exceeded SSSLs in groundwater: 1,1,2,2-tetrachloroethane (five sample location), 1,1,2-trichloroethane (one sample location), acetone (four sample locations), carbon tetrachloride (two sample locations), chloroform (ten sample locations), tetrachloroethene (one sample location), and trichloroethene (three sample locations). Although acetone concentrations exceeded its SSSL in groundwater, acetone concentrations in soils were very low and were below SSSLs and ESVs, suggesting that a groundwater source in soils is not present. Based on the soil and groundwater results and the fact that acetone is a common laboratory contaminant, acetone's status as a site-related chemical of concern was not conclusively determined during the SI. Therefore, the proposed RI field activities (Chapter 4.0) will be used to determine nature and extent of acetone at the Training Area T-5 Site.

The most significant finding of the SI was the detection of the aforementioned chlorinated VOCs in groundwater. Based on the results of the SI, an RI was recommended to determine the nature and extent of contamination at the Training Area T-5 Sites. The additional data will aid in the development of the site hydrogeologic model as well as provide information necessary for the completion of the human health and ecological risk assessments. Data collected during the RI will also confirm or deny acetone's presence in groundwater.

3.0 Site-Specific Data Quality Objectives

3.1 Overview

The data quality objective (DQO) process is followed to establish data requirements. This process ensures that the proper quantity and quality of data are generated to support the decision-making process associated with the future action for Training Area T-5 Sites. This section incorporates the components of the DQO process described in the EPA publication *Guidance for the Data Quality Objectives Process*, EPA 600/R-96/005 (EPA, 2000). The DQO process as applied to the Training Area T- 5 Sites is described in more detail in Section 3.0 of the QAP, contained in the SAP (IT, 2002a). Table 3-1 provides a summary of the factors used to determine the appropriate quantity of samples and the procedures necessary to meet the objectives of the RI and to establish a basis for future action at this site.

To support this RI at Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7), four types of samples will be collected for analysis: groundwater, soil, surface water, and sediment.

The water, soil, and sediment matrix samples will be analyzed for this RI using EPA SW-846 methods, including Update III methods where applicable, as presented in Chapter 5.0 in this RI SFSP and in Table 6-1 in the QAP (IT, 2002a). Data will be reported and evaluated in accordance with the definitive data requirements of Chapter 2.0 of the USACE Engineering Manual 200-1-6, *Chemical Quality Assurance for Hazardous, Toxic, and Radioactive Waste (HTRW) Projects* (USACE, 1997) and evaluated by the stipulated requirements for the generation of definitive data (Section 7.2.2 of the QAP). Chemical data will be reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms along with electronic copies. These packages will be validated in accordance with EPA National Functional Guidelines Level III criteria.

3.2 Data Users and Available Data

The available data related to the RI SFSP at the Training Area T-5 Sites, presented in Table 3-1, have been used to formulate a site-specific conceptual model. This conceptual model was developed to support the development of this RI SFSP, which is necessary to meet the objectives of these activities and to establish a basis for future action at the site. The data users for information generated during field activities are primarily EPA, USACE, ADEM, FTMC, and the USACE supporting contractors. This RI SFSP, along with the necessary companion documents, has been designed to provide the regulatory agencies with sufficient detail to reach a determination as to the adequacy of the scope of work. The program has also been designed to provide defensible information required to confirm or deny the existence and nature of residual chemical contamination in site media.

3.3 Conceptual Site Exposure Model

The conceptual site exposure model (CSEM) provides the basis for identifying and evaluating the potential risks and hazards to human health in the risk assessment. The CSEM includes receptors and potential exposure pathways appropriate to all plausible scenarios. The CSEM facilitates consistent and comprehensive evaluation of human health through graphically presenting all possible exposure pathways, including sources, release and transport pathways, and exposure routes. In addition, the CSEM helps to ensure that potential pathways are not overlooked. The elements of a complete exposure pathway and CSEM are:

- Source (i.e., contaminated environmental) media
- Contaminant release mechanisms
- Contaminant transport pathways
- Receptors
- Exposure pathways.

Contaminant release mechanisms and transport pathways are not relevant for direct receptor contact with a contaminated source medium.

Primary contaminant releases were probably leaks and spills that entered surface soil. Potential contaminant transport pathways include infiltration and leaching to subsurface soil and groundwater, dust emissions and volatilization to ambient air, and biotransfer to deer through browsing. Runoff and erosion to surface water and sediment may also be contaminant transport pathways. If possible, one surface water and sediment sample will be collected from an intermittent stream at the T-5 Sites.

These sites have heavily wooded areas as well as areas of abandoned buildings with mowed grass. The sites are in an unused area of the Main Post. Most of the sites have a portion that is fenced, but access to some areas is not restricted. Because trespassers or hunters may access the site, a recreational site user who hunts will be evaluated for the current land-use scenario. Currently, some of the sites are mowed on a regular basis, so the groundskeeper will also be evaluated for the current land-use scenario. Other potential receptors considered, but not included under current land-use scenarios, are:

- ***Construction Worker.*** The sites are closed, and no development or construction is occurring, but minimal construction could occur in maintaining the present buildings for a future use. The maintenance of these buildings is not expected to involve disturbing the soil.

- ***Resident.*** The site is not currently used for residential purposes.

Proposed future land use in this area is a combination of remediation reserve for passive recreation, retirement development reserve and mixed business use (EDAW, 1997). Thus, the following future land-use receptor scenarios are included in the CSEM:

- ***Resident.*** Although some of the sites are not likely to be used for residential purposes, the resident is considered in order to provide information for the project manager and regulators as well as for the retirement development reserve.

- ***Construction Worker.*** Development of some of the Training Area T-5 Sites is expected in the retirement development reserve and mixed business use area.

- ***Groundskeeper.*** It is expected that minimal lawn services at the sites currently being mowed would continue.

- ***Recreational Site User.*** Because a portion of the area will be part of the remediation reserve and hunting by trespassers is a viable option, the recreational site user will be included.

A summary of relevant contaminant release and transport mechanisms, source and exposure media, and receptors and exposure pathways for this site is provided in Table 3-1 and Figure 3-1.

3.4 Decision-Making Process, Data Uses, and Needs

The seven-step decision-making process is presented in detail in Section 3.0 of the QAP and will be followed during the RI at the Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7). Data uses and needs are summarized in Table 3-1.

3.4.1 Risk Evaluation

Confirmation of contamination at the Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7), will be based on using EPA definitive data to determine whether or not PSSCs are detected in site media. Results from these analyses will be compared with SSSLs, ESVs, and background values to determine if PSSCs are present at the site at concentrations that pose an unacceptable risk to human health or the environment. Definitive data will be adequate for confirming the presence of site contamination and for supporting a feasibility study and risk assessment.

Assessment of potential ecological risk associated with sites or parcels (e.g., surface water and sediment sampling, specific ecological assessment methods) will be addressed in accordance with the procedures in Section 5.3 of the installation-wide work plan (IT, 2002b).

3.4.2 Data Types and Quality

Surface soil, subsurface soil, groundwater, depositional soil, surface water, and sediment will be sampled and analyzed to meet the objectives of the RI at the Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7). In association with these definitive samples, quality assurance/quality control (QA/QC) samples will be collected for sample types as described in Chapter 5.0 of this RI SFSP.

Samples will be analyzed by EPA-approved SW-846 methods Update III, where available, comply with EPA definitive data requirements, and be reported using hard-copy data packages. In addition to meeting the quality needs of this RI SFSP, data analyzed at this level of quality are appropriate for all phases of site characterization, RI, and risk assessment.

3.4.3 Precision, Accuracy, and Completeness

Laboratory requirements of precision, accuracy, and completeness for this RI are provided in Section 3.1 of this SFSP and presented in Section 5.0 of the QAP (IT, 2002a).

4.0 Field Investigations

4.1 Technical Approach

The purpose of the proposed field investigation at the Training Area T-5 Sites is to define the nature and extent of contamination associated with the detection of VOCs in the groundwater samples collected from the T-5 Sites. The delineation of contamination in the residuum aquifer will be addressed by the installation of an additional eleven residuum groundwater monitoring wells upgradient, crossgradient, and downgradient of 26 existing monitoring wells at these sites. To determine if the contaminants have migrated vertically, IT proposes to install eleven bedrock monitoring wells, each paired with a proposed or existing residuum monitoring well. Metals and VOCs detected during the SI in surface soil, subsurface soil, and depositional soil will also be further evaluated by collecting additional samples from each sample media. Soil samples from soil borings will be collected only from residuum monitoring wells because each bedrock monitoring well will be installed adjacent to a residuum monitoring well where lithology has been or will be characterized. If contamination is found at any of these new sample locations, an evaluation of the data will determine if additional phases of work may be required to complete the RI. The purpose of the depositional soil samples will be to verify the presence of "hot spots" in drainage pathways observed during SI sampling.

Only one surface water and sediment sample is currently proposed, however, if surface water is observed during the course of field investigation, surface water and sediment samples may be collected in place of the depositional soil samples.

4.2 UXO Survey Requirements and Utility Clearances

The U.S. Army Corps of Engineers-Huntsville requires that work conducted at potential CWM sites use UXO anomaly avoidance techniques. Therefore, prior to initiating field activities at Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7), IT will conduct UXO avoidance activities as outlined in Appendix E of the SAP and the attached site-specific UXO safety plan. Surface sweeps and downhole surveys will be conducted to identify anomalies for the purpose of UXO avoidance.

4.2.1 Surface UXO Survey

A UXO sweep will be conducted over areas that will be included in the sampling and surveying activities to identify UXO on or near the surface that may present a hazard to on-site workers during field activities. Low-sensitivity magnetometers will be used to locate surface and shallow-buried metal objects. UXO located on the surface will be identified and conspicuously marked for easy avoidance. UXO personnel requirements, procedures, and detailed descriptions of the geophysical equipment to be used are provided in Chapter 4.0 and Appendix E of the approved SAP (IT, 2002a).

4.2.2 Downhole UXO Survey

During the soil boring and downhole sampling activities, a downhole UXO survey will be performed to determine if buried metallic objects are present. UXO monitoring as described in Chapter 4.0 of the SAP (IT, 2002a) will continue until undisturbed soils are encountered or the borehole has been advanced to 12 feet bgs, whichever is reached first.

4.2.3 Utility Clearances

After the UXO surface survey has cleared the area to be sampled and prior to performing any intrusive sampling, a utility clearance will be performed at all locations where soil and groundwater samples will be collected, using the procedure outlined in Section 4.2.6 of the SAP. The site manager will mark the proposed locations with stakes, coordinate with the appropriate utility companies to clear the proposed locations for utilities, and obtain digging permits. Once the locations are approved (for both UXO and utility avoidance) for intrusive sampling, the stakes will be labeled as cleared.

4.3 Environmental Sampling

The environmental sampling program during the RI for Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7), includes the collection of surface and subsurface soil, groundwater, surface water, sediment, and depositional soil samples for chemical analyses. The proposed sampling is intended to provide sufficient data to complete the RI; however, if additional contaminants are detected, additional phases of groundwater monitoring well installation and sampling may be required. In addition, if ponded water is observed during field investigations, surface water, and sediment samples may be collected in place of some of the depositional soil samples.

4.3.1 Surface Soil Sampling

A surface soil sample and subsurface soil sample will be collected for chemical analysis at eleven residuum monitoring well locations.

4.3.1.1 Sample Locations and Rationale

The rationale for the proposed groundwater monitoring wells and soil boring locations and the associated surface and subsurface soil samples is listed in Table 4-1. The assigned sample numbers and the associated field QA/QC sample requirements are summarized in Table 4-2.

4.3.1.2 Sample Collection

Surface soil samples will be collected from the uppermost foot of soil by direct-push methodology as specified in Section 5.1.1.1 of the SAP (IT, 2002a). In areas where site access does not permit the use of a direct-push rig, the samples will be collected using a stainless steel hand auger as specified in Section 5.1.1.2 and Section 6.1.1.1 of the SAP. Collected soil samples will be screened using a PID in accordance with Section 6.8.3 of the SAP. Surface soil samples will be screened for information purposes only, not to aid in the selection of samples for analysis. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SFSP are discussed in Chapter 4.0 and listed in Table 4-1 of the QAP. Sample documentation and chain-of-custody (COC) will be recorded as specified in Chapter 6.0 of the SAP. The samples will be analyzed for the parameters listed in Section 4.6 of this SFSP.

4.3.2 Subsurface Soil Sampling

Subsurface soil samples will be collected during the RI from the eleven proposed residuum monitoring well locations (Figure 4-1).

4.3.2.1 Sample Locations and Rationale

Subsurface soil sampling rationale is presented in Table 4-1. A total of 11 subsurface soil samples will be collected in this RI. Subsurface soil sample designations and QA/QC sample requirements are summarized in Table 4-2.

4.3.2.2 Sample Collection

Subsurface soil samples will be collected from soil borings at a depth greater than 1 foot bgs in the unsaturated zone. The soil borings will be advanced and soil samples collected using the direct-push sampling procedures specified in Section 5.1.1.1 and Section 6.1.1.1 of the SAP (IT, 2002a). In areas where site access does not permit the use of a direct-push rig, the samples will be collected using a hand auger, as specified in Sections 5.1.1.2 and 6.1.1.1 of the SAP.

Soil samples will be collected continuously for the first 12 feet or until either groundwater or refusal is met. A detailed lithological log will be recorded by the on-site geologist for each borehole. At least one subsurface sample from each borehole will be selected for analysis. The collected subsurface soil samples will be field-screened using a PID in accordance with Section 6.8.3 of the SAP to measure samples exhibiting elevated readings exceeding background (readings in ambient air). Typically, the subsurface soil sample showing the highest reading (above background) will be selected and sent to the laboratory for analysis. If none of the samples indicates a reading exceeding background using the PID, the deepest interval from the soil boring will be sampled and submitted to the laboratory for analysis. Subsurface soil samples may be selected for analysis from any depth interval if the on-site geologist suspects PSSCs at the interval. Site conditions such as lithology may also determine the actual sample depth interval submitted for analysis. More than one subsurface soil sample may be collected if field measurements and observations indicate a possible layer of PSSCs and/or additional sample data would provide insight to the existence of any PSSCs.

Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SFSP are discussed in Chapter 4.0 and listed in Table 4-1 of the QAP. The samples will be analyzed for the parameters listed in Section 4.6 of this SFSP.

4.3.3 Monitoring Well Installation

Eleven residuum and eleven bedrock monitoring wells are proposed at Training Area T-5 Sites (Figure 4-1). The monitoring wells will be installed using a combination of hollow-stem auger, air-rotary, and or eccentric rotary (ODEX™ or equivalent) drilling methods. The wells will be installed to provide additional information on water quality and groundwater flow in both the residuum and bedrock aquifers. The SI performed by IT in 2001 and 2002 indicated the presence of VOCs, therefore, additional wells will be installed to delineate the vertical and horizontal extent of contamination. Bedrock monitoring wells will be drilled using air-rotary drilling methods. The monitoring wells will be installed and developed as specified in Section 4.8 and Appendix C of the SAP.

4.3.3.1 Monitoring Well Locations and Rationale

Groundwater samples will be collected from the 22 proposed monitoring wells and 26 pre-existing monitoring wells at the Training Area T-5 Sites. Newly proposed monitoring wells (Figure 4-1) will be located to define the lateral and vertical extent of groundwater contamination. Eleven proposed residuum monitoring wells will be installed to further characterize the local groundwater flow and to delineate the lateral extent of contamination in the residuum aquifer.

Eleven proposed bedrock monitoring wells will be installed in order to establish the presence or absence of groundwater contamination in the deeper groundwater zones at the site.

The locations of the existing and proposed monitoring wells are presented on Figure 4-1, and Table 4-1 presents proposed monitoring well sampling rationale. The exact location of each proposed monitoring well will be determined in the field by the on-site geologist, based on actual field conditions.

4.3.3.2 Residuum Monitoring Wells

Eleven residuum monitoring well boreholes will be drilled and installed using 4.25-inch inside diameter (ID) hollow-stem augers. Residuum monitoring wells will be drilled to a minimum of 20 feet below the first groundwater-bearing zone, estimated range from 20 to 40 bgs, or to the top of bedrock, whichever is encountered first. Samples will be collected at 5-foot intervals from 12 feet bgs (or at direct-push sample refusal) to the total well depth by the on-site geologist (to record lithologic information). The well casing will consist of new 2-inch ID, Schedule 40, threaded, flush-joint, polyvinyl chloride (PVC) pipe. Attached to the bottom of the well casing will be a section of new threaded, flush-joint, 0.010-inch continuous wrap PVC well screen, 10 to 20 feet long. At the discretion of the IT site manager, a sump (composed of a new 2-inch ID, Schedule 40, threaded, flush-joint PVC pipe). After the casing and screen materials are lowered into the boring, a filter pack will be installed around the well screen. The filter pack will be tremied into place from the bottom of the well to approximately 5 feet above the top of the screen. The filter pack will consist of 20/40 silica sand. A fine sand (30/70 silica sand), approximately five feet thick, may be placed above the filter pack. A bentonite seal approximately 5 feet thick will be placed above the filter pack (or fine sand if used). The remaining annular space will be grouted with a bentonite-cement mixture, using approximately 7 to 8 gallons of water and approximately 5 pounds of bentonite per 94-pound bag of Type I or Type II Portland cement. The grout will be tremied into place from the top of the bentonite seal to ground surface. Monitoring wells will be completed with stick-up or flush-mount construction as determined by the project geologist. Investigation-derived waste (IDW) will be containerized and staged in accordance with Section 4.8 of this RI SFSP.

Soil samples for lithologic characterization will be collected starting at five feet bgs, and at five-foot intervals thereafter, to the total depth of the borehole. Lithologic samples will be collected and described to provide a detailed lithologic log. The samples will be collected using a 24-inch-long, 2-inch-or-larger-diameter split-spoon sampler. The soil borings will be logged in accordance with ASTM Method D 2488 using the Unified Soil Classification System. The soil samples will be screened in the field for the presence of VOCs contamination using a PID. The monitoring wells will be drilled, installed, and developed as specified in Section 5.1 and Appendix C of the SAP (IT, 2002a). The exact monitoring well locations will be determined in the field by the on-site geologist, based on actual field conditions. Monitoring wells will be allowed to equilibrate for 14 days after well development prior to collecting groundwater samples.

4.3.3.3 Bedrock Monitoring Wells

Eleven bedrock monitoring wells will be installed using air rotary drill techniques and wireline coring. Estimated well depths are expected to be less than 100 feet and are presented in Table 4-1.

An air rotary rig with a 12-inch percussion bit or rotary bit will be used to drill the borehole from land surface to a target depth of 5 feet into competent bedrock or 5 feet below the bottom of the adjacent residuum monitoring well. The compressor on the drill rig will be equipped with an air filter between the compressor and the drill bit. Since the bedrock well will be installed adjacent to a proposed or pre-existing residuum well where lithology has been or will be characterized, no residuum sampling will be performed at the bedrock well location for the purpose of characterizing residuum lithology.

Ten-inch ID carbon steel International Pipe Standard outer casing will be installed into the borehole from land surface to a target depth presented in Table 4-1. A minimum of two inches of annular space will be required between the outer casing and borehole wall. The eight-inch carbon steel outer casing will be grouted in place using a tremie pipe suspended in the annulus outside the casing. Bentonite-cement grout will be mixed using approximately 6.5 to 7 gallons of water and approximately 5 pounds of bentonite per 94-pound bag of Type I Portland cement. After the grout has cured a minimum of 48 hours, the borehole will be advanced with a PQ diamond-tipped wireline triple-tube core barrel with a 5-foot longitudinally split inner tube, to collect core samples from the bottom of the steel casing to the projected well completion depth in accordance with ASTM Method D 2113, *Standard Practice for Diamond Core Drilling for Site Investigation* (1993). Bedrock cores will be described following methodology outlined in Corps of Engineers South Atlantic Division Manual DM 1110-1-1 (USACE, 1983). Proposed well completion depths and outer casing target depths are summarized in Table 4-1. Upon completion of the coring, the borehole will be reamed with a 7-7/8-inch air percussion bit from the bottom of the steel casing to the projected well completion depth.

A four-inch monitoring well will be installed inside the outer casing at each proposed well location. The well casing will consist of new, 4-inch ID, Schedule 80, threaded, flush-joint PVC pipe. Attached to the bottom of the well casing will be a section of new threaded, flush joint 0.010-inch continuous wrap PVC well screen, 10 to 20 feet long. A 5-foot sump may be installed at the discretion of the on-site geologist based on actual site conditions and bedrock characteristics. After the casing and screen materials are lowered into the boring, a filter pack will be installed around the well screen. The filter pack will be tremied into place from the bottom of the well (or sump) to approximately 5 feet above the top of the screen. The filter pack will consist of 20/40 silica sand. A bentonite seal, approximately 5 feet thick, will be placed above the filter pack. The remaining annular space will be grouted with a bentonite-cement mixture (described above) and tremied in place with a side-discharge tremie from the top of the bentonite seal to ground surface. The bedrock monitoring wells will be developed as specified in Section 4.8 and Appendix C of the SAP. Groundwater samples will not be collected from bedrock wells for a period of at least 14 days after well development. IDW will be containerized and staged in accordance with Section 4.8 of this SFSP.

4.3.4 Monitoring Well Groundwater Sampling

Groundwater samples will be collected from 22 proposed permanent monitoring wells and 26 pre-existing monitoring wells at the Training Area T-5 Sites. Chemical analytical parameters are listed in Section 4.6 of this SFSP, and field parameter measurements to be made at the time of sample collection are detailed in Section 6.3 of the SAP.

4.3.4.1 Monitoring Well Sample Locations and Rationale

The pre-existing and proposed groundwater monitoring wells are depicted in Figure 4-1. The rationale for the location of each proposed well is described in Table 4-1. The well locations were chosen to delineate the boundaries of the contaminants found in the monitoring wells at Training Area T-5 Sites.

4.3.4.2 Monitoring Well Sample Collection

Prior to sampling, static water levels will be measured from the monitoring wells to be sampled as part of the this RI. Groundwater elevations will be used to define the groundwater flow in the residuum and bedrock aquifers. Water levels will be measured as outlined in Section 5.5 of the SAP (IT, 2002a). Groundwater samples will be collected from the pre-existing and proposed permanent monitoring wells and analyzed for the parameters listed in Table 4-1. Groundwater samples will be collected by the procedures outlined in Section 6.1.1.5 and Attachment 5 of the SAP. Low-flow groundwater sampling methodology outlined in Attachment 5 of the SAP may be used as deemed necessary by the IT site manager.

Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this RI SFSP are listed in Section 5.0, Table 5-1, of the QAP (IT, 2002a). Table 4-3 lists groundwater sample designations and associated QA/QC sample designations and quantities.

4.3.5 Slug Tests

The hydraulic conductivity of the geologic material underlying Training Area T-5 Sites, Parcels 180(7), 182(7), 511(7), 512(7), 513(7), 514(7), and 516(7), will be estimated by performing slug tests in six permanent monitoring wells (3 residuum and 3 bedrock). Rising head (slug out) and/or falling head (slug in) tests will be conducted and drawdown measurements taken with a pressure transducer and data logger from selected monitoring wells. Slug tests will be conducted in accordance with procedures outlined in Section 5.4.1 and Attachment 3 of the SAP (IT, 2002a). Slug tests will be performed after groundwater sampling has been completed.

4.3.6 Surface Water Sampling

One surface water sample will be collected from the intermittent stream that flows north along the eastern boundary of Training Area T-5, Parcel 182(7).

4.3.6.1 Sample Locations and Rationale

The surface water location and sampling rationale are listed in Table 4-1. The surface water sample will be collected from the proposed location on Figure 4-1. The surface water sample designation and QA/QC sample requirements are listed in Table 4-4. The exact sampling location will be determined in the field by the ecological sampler, based on drainage pathways and actual field observations.

4.3.6.2 Sample Collection

The surface water sample will be collected in accordance with the procedures specified in Section 6.1.1.3 of the SAP (IT, 2002a). Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SFSP are discussed in Chapter 4.0 and listed in Table 4-1 of the QAP. The sample will be analyzed for the parameters listed in Section 4.6 of this SFSP.

4.3.7 Sediment Sampling

One sediment sample will be collected from the same location as the surface water sample described in Section 4.3.6.

4.3.7.1 Sample Locations and Rationale

The proposed location for the sediment sample is shown in Figure 4-1. Sediment sampling rationale is presented in Table 4-1. The sediment sample designation and QA/QC sample requirements are listed in Table 4-4. The actual sediment sample point will be at the discretion of the ecological sampler, based on the drainage pathways and actual field observations.

4.3.7.2 Sample Collection

The sediment sample will be collected in accordance with the procedures specified in Section 6.1.1.2 of the SAP. Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SFSP are discussed in Chapter 4.0 and listed in Table 4-1 of the QAP. The sediment sample will be analyzed for the parameters listed in Section 4.6 of this SFSP.

4.3.8 Depositional Soil Sampling

Ten depositional soil samples will be collected from drainage swale and depression locations throughout the Training Area T-5 Sites.

4.3.8.1 Sample Locations and Rationale

The proposed locations for the depositional soil samples are shown in Figure 4-1. Depositional soil sampling rationale for each location is presented in Table 4-1. The depositional soil sample designations and QA/QC sample requirements are listed in Table 4-4. The actual depositional soil sample points will be at the discretion of the ecological sampler, based on the drainage pathways and actual field observations.

4.3.8.2 Sample Collection

The depositional soil will be collected in accordance with the procedures specified in Section 4.2.1 of this SFSP for surface soil. Sample documentation and COC will be recorded as specified in Chapter 6.0 of the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SFSP are discussed in Chapter 4.0 and listed in Table 4-1 of the QAP. The depositional soil samples will be analyzed for the parameters listed in Section 4.6 of this SFSP.

4.3.9 Surface Water and Sediment Sampling Contingency

Several of the locations planned for depositional soil samples may have surface water when the sampling is conducted. If there is standing water or other obvious surface water features at any of the locations, a surface water sample and sediment sample may be collected at the discretion of the on-site field geologist or site manager in place of the depositional soil sample. Chemical data from surface water and sediment from standing ponds or drainage ditches that may be used as a water source for small animals will be useful for the purposes of supporting an ecological risk assessment. If collected, any additional surface water and sediment samples will be collected in accordance with procedures specified in Sections 4.3.6 and 4.3.7 of this SFSP.

4.4 Decontamination Requirements

Decontamination will be performed on sampling and nonsampling equipment, primarily to ensure that contaminants are not introduced into samples from location to location. Decontamination of sampling equipment will be performed in accordance with the requirements presented in Section 4.10.1.1 of the SAP. Decontamination of nonsampling equipment will be performed in accordance with the requirements presented in Section 4.10.1.2 of the SAP.

4.5 Surveying of Sample Locations

Sampling locations will be marked with pin flags, stakes, and/or flagging and will be surveyed using either GPS or conventional civil survey techniques, as necessary to obtain the required level of accuracy. Horizontal coordinates will be referenced to the U.S. State Plane coordinate system, Alabama East Zone, North American Datum 1983. Elevations will be referenced to the North American Vertical Datum of 1988.

Horizontal coordinates for soil, sediment, and surface water locations will be recorded using a GPS to provide accuracy within one meter. Because of the need to use monitoring wells to determine water levels, a higher level of accuracy is required. Monitoring wells will be surveyed to an accuracy of 0.1 foot for horizontal coordinates and 0.01 foot for elevations, using survey-grade GPS techniques and/or conventional civil survey techniques, as required. Procedures to be used for GPS surveying are described in Section 4.3 of the SAP. Conventional land survey requirements are presented in Section 4.19 of the SAP.

4.6 Analytical Program

Definitive samples collected at the locations specified in this chapter will be analyzed for various chemical constituents (including agent breakdown products) and physical properties based on the PSSCs historically used at the site and EPA, ADEM, FTMC, and USACE requirements. Definitive target analyses for soil and water samples collected from the Training Area T-5 Sites consist of the following list of analytical suites:

- Target compound list VOCs by EPA Method 5035/8260B

- Target compound list SVOCs by EPA Method 8270C

- TAL metals by EPA Method 6010B/7000

- Chemical agent breakdown products by EPA Method 8270 (modified) and Method 8321.

In addition, sediment samples will be analyzed for the following parameters:

- Total Organic Carbon – EPA Method 9060
- Grain size – ASTM D421/D422.

The samples will be analyzed using EPA SW-846 methods, including Update III Methods where applicable, as presented in Table 4-5 in this SFSP and Chapter 5.0 in the QAP. Data will be reported in accordance with definitive data requirements of Chapter 2 of the USACE Engineering Manual 200-1-6, *Chemical Quality Assurance For Hazardous, Toxic and Radioactive Waste (HTRW) Projects* (USACE, 1997), and evaluated by the stipulated requirements for the generation of definitive data (Section 7.2.2 of the QAP). Chemical data will be reported by the laboratory via hard-copy data packages using Contract Laboratory Program-like forms, along with electronic copies. These packages will be validated in accordance with EPA National Functional Guidelines by Level III criteria.

4.7 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping will follow the procedures specified in Sections 6.1.3 through 6.1.7 of the SAP (IT, 2002a). Completed analysis request/COC records will be secured and included with each shipment of coolers to both laboratories. The samples will be shipped to the following laboratory:

Attention: Sample Receiving/ Elizabeth McIntyre
EMAX Laboratories, Inc.
1835 205th Street
Torrence, California 90501
Telephone: (310) 618-8889
Fax: (310) 618-0818.

4.8 Investigation-Derived Waste Management

Management and disposal of IDW will follow procedures and requirements as described in Appendix D of the SAP (IT, 2002a). The IDW expected to be generated at Training Area T-5 Sites will include drill cuttings, purge water from permanent monitoring well development and sampling activities, decontamination fluids, and disposable personal protective equipment. The IDW will be characterized and staged at a secure location designated by the site manager while awaiting final disposal. Sampling of the IDW to obtain analytical results for characterizing the waste for disposal will follow procedures specified in Section 6.1.1.8 of the SAP.

IDW generated during well installation and groundwater sampling will be managed in accordance with the procedures outlined in Appendix D of the SAP. Drill cuttings and water will be generated during drilling as the bit and rods are advanced. The cuttings and water shall be directly diverted into a lined, watertight, roll-off box per methodology previously established during drilling activities at FTMC.

It is proposed that liquid IDW generated during this RI be treated and disposed of on site as shown in the schematic on Figure 4-2. After allowing time for settling, untreated liquids (from drilling and groundwater sampling) in the first roll-off box will be siphoned from the top of the liquid layer, pumped through a sand filter and then through a granular activated carbon (GAC) canister into a second lined, watertight, roll-off box. The intent of the sand filter is to extract suspended drill cuttings to reduce particles going into the GAC. The GAC will remove VOCs in the water. When the second box is approximately 75 percent full of treated water, a grab sample of the treated water in the second box will be collected and analyzed for VOCs, using a quick turnaround time. Assuming the treated water has no detections of VOCs above surface water ESVs, it will be discharged onto the ground using a submersible pump. The treated water will be allowed to percolate into the ground but not allowed to flow directly into a drainage ditch or creek.

4.9 Site-Specific Safety and Health

Safety and health requirements for the RI are provided in the SSHP attachment for the Training Area T-5 Sites. The SSHP attachment will be used in conjunction with the installation-wide safety and health plan and the site-specific UXO safety plan.

5.0 Project Schedule

The project schedule for the RI activities will be provided by the IT project manager to the BRAC Cleanup Team and will be in accordance with the work plan.

6.0 References

American Society for Testing and Materials (ASTM), 1993, ***Standard Practice for Diamond Core Drilling for Site Investigation***, ASTM Method D 2113.

Cloud, P. E., Jr., 1966, ***Bauxite Deposits of the Anniston, Fort Payne, and Asheville Areas, Northeast Alabama,*** U. S. Geological Survey Bulletin 1199-O, 35p.

Environmental Science and Engineering Inc. (ESE), 1998, ***Final Environmental Baseline Survey, Fort McClellan, Alabama***, prepared for U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland, January.

EDAW, Inc., (EDAW), 1997, ***Fort McClellan Comprehensive Reuse Plan***, prepared under contract to the Calhoun County Commission, November.

IT Corporation (IT), 2002a, ***Draft Revision 3, Installation-Wide Sampling and Analysis Plan, Fort McClellan, Calhoun County, Alabama***, February.

IT Corporation (IT), 2002b, ***Draft Revision 2, Installation-Wide Work Plan, Fort McClellan, Calhoun County, Alabama***, February.

IT Corporation (IT), 2000a, ***Chemical Warfare Material Sites – Agent ID Area (Parcel 509), Training Area T-6 (Naylor Field) (Parcel 183), Blacktop Training Area (Parcel 511), Fenced Yard in Blacktop Area (Parcel 512), Dog Training Area (Parcel 513), Dog Kennel Area (Parcel 516), Training Area T-5 (Parcel 182), Former Detection and Identification Area (Parcel 180), Old Burn Pit (Parcel 514), CBR Proficiency Area (Parcel 517), and Old Toxic Training Area (Parcel 188), Fort McClellan, Calhoun County, Alabama***, October.

IT Corporation (IT), 2000b, ***Bauxite Deposits of the Anniston, Fort Payne, and Asheville Areas, Northeast Alabama***, U.S. Geological Survey Bulletin 1199-O.

IT Corporation (IT), 2000c, ***Final Human Health and Ecological Screening Values and PAH Background Summary Report***, July.

IT Corporation (IT), 1998, ***Final Installation-Wide Work Plan, Fort McClellan, Calhoun County, Alabama***, August.

Moser, P. H., and S. S. DeJarnette, 1992, ***Ground-water Availability in Calhoun County, Alabama,*** Geological Survey of Alabama Special Map 228.

Osborne, W. E., 1999, Personal Communication concerning regional geology in Calhoun County, Alabama with John Hofer, IT Corporation.

Osborne, W. E., G. D. Irving, and W. E. Ward, 1997, ***Geologic Map of the Anniston 7.5' Quadrangle, Calhoun County, Alabama***, Geological Survey of Alabama Preliminary Map, 1 sheet.

Osborne, W. E., M. W. Szabo, C. W. Copeland, Jr., and T. L. Neathery, 1989, ***Geologic Map of Alabama,*** Geological Survey of Alabama Special Map 221, scale 1:500,000, 1 sheet.

Osborne, W. E., M. W. Szabo, T. L. Neathery, and C. W. Copeland, compilers, 1988, ***Geologic Map of Alabama, Northeast Sheet***, Geological Survey of Alabama Special Map 220, Scale 1:250,000.

Osborne, W. E. and M. W. Szabo, 1984, ***Stratigraphy and Structure of the Jacksonville Fault, Calhoun County, Alabama,*** Geological Survey Circular 117.

Parsons Engineering Science, Inc. (Parsons), 2002, ***Final Chemical Warfare Materiel Engineering Evaluation/Cost Analysis, Fort McClellan, Alabama***, June.

Planert, Michael, and James L. Pritchett, Jr., 1989, ***Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama, Area 4,*** U.S. Geological Survey, Water Resources Investigation Report 88-4133, prepared with the Alabama Department of Environmental Management, Tuscaloosa, Alabama.

Raymond D. E., W. E. Osborne, C. W. Copeland, and T. L. Neathery, 1988, ***Alabama Stratigraphy***, Geological Survey of Alabama, Tuscaloosa, Alabama.

Science Application International Corporation (SAIC), 1998, ***Background Survey Report, Fort McClellan, Anniston, Alabama***, prepared for U.S. Army Corps of Engineers, Mobile, Alabama, July.

Science Application International Corporation (SAIC), 1988, ***Final Background and Metals Survey Report, Fort McClellan, Alabama***, July.

Science Application International Corporation (SAIC), 1995, ***Draft Fort McClellan Remedial Investigation Report***, August.

Science Application International Corporation (SAIC), 1993, ***Site Investigation Report***, prepared for the U.S. Army Environmental Center, Aberdeen Proving Grounds, Maryland, August.

Scott J. C., W. F. Harris, and R. H. Cobb, 1987, ***Geohydrology and Susceptibility of Coldwater Spring and Jackson Fault Areas to Surface Contamination in Calhoun County, Alabama***, U.S. Geological Survey Water Resources Investigations Report 87-4031.

Szabo, M. W., W. E. Osborne, C. W. Copeland, Jr., and T. L. Neathery, compilers, 1988, ***Geologic Map of Alabama***: Alabama Geological Survey Special Map 220, scale 1:250,000, 5 sheets.

Thomas, W. A., and T. L. Neathery, 1982, ***Appalachian Thrust Belts in Alabama: Tectonics and Sedimentation***, Geologic Society of America 1982 Annual Meeting, New Orleans, Louisiana, Field Trip, Alabama Geological Society Guidebook 19A.

Thomas, W. A., and J. A. Drahovzal, 1974, ***The Coosa Deformed Belt in the Alabama Appalachians***, Alabama Geological Society, 12th Annual Field Trip Guidebook.

U.S. Army Corps of Engineers (USACE), 2002, ***Statement of Work for Task Order CK19, Remedial Investigations/Feasibility Studies at Chemical Warfare Material Sites, Fort McClellan, Alabama***, June.

U.S. Army Corps of Engineers (USACE) 2001, ***Archives Search Report, Revision 1***, Fort McClellan, Anniston, Alabama, September.

U.S. Army Corps of Engineers (USACE), 1997, ***Engineer Manual 200-1-6, Chemical Quality Assurance For Hazardous, Toxic and Radioactive Waste (HTRW) Projects***.

U.S. Army Corps of Engineers (USACE), South Atlantic Division, 1983, ***Engineering and Design Geotechnical Manual for Surface and Subsurface Investigations,*** Division Manual, DM 1110-1-1, July.

U.S. Department of Agriculture, 1961, ***Soil Survey, Calhoun County, Alabama***, Soil Conservation Service, Series 1958, No. 9, September.

U.S. Department of the Army and Air Force, 1963, ***Military Chemistry and Chemical Agents, U.S. Department of Commerce, National Technical Information Service,*** December.\

U.S. Environmental Protection Agency (EPA), 2000, ***Guidance for the Data Quality Objectives Process***, EPA 600/R-96/005.

U.S. Environmental Protection Agency (EPA), 1993, ***Data Quality Objectives Process for Superfund, Interim Final Guidance***, EPA 540-R-93-071, September.

U.S. Environmental Protection Agency (EPA), 1988, ***Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final***.

U.S. Army Center for Health Promotion and Preventative Medicine (CHPPM), 1999, ***Preliminary Assessment No. 38-EH-1775-99, Fort McClellan Army National Guard Training Center,*** Fort McClellan, Alabama, May 28-June 17.

Warman, J. C., and L. V. Causey, 1962, ***Geology and Groundwater Resources of Calhoun County, Alabama,*** Alabama Geological Survey County Report 7, 77 p.

Weston, Roy F., Inc., 1990, ***Final USATHAMA Task Order 11, Enhanced Preliminary Assessment, Fort McClellan, Anniston, Alabama,*** prepared for U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland, December.

ATTACHMENT 1

LIST OF ACRONYMS AND ABBREVIATIONS

List of Abbreviations and Acronyms

2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4,5-TP	silvex
3D	3D International Environmental Group
AB	ambient blank
AbB3	Anniston gravelly clay loam, 2 to 6 percent slopes, severely eroded
AbC3	Anniston gravelly clay loam, 6 to 10 percent slopes, severely eroded
AbD3	Anniston and Allen gravelly clay loams, 10 to 15 percent slopes, eroded
Abs	skin absorption
ABS	dermal absorption factor
AC	hydrogen cyanide
ACAD	AutoCadd
AcB2	Anniston and Allen gravelly loams, 2 to 6 percent slopes, eroded
AcC2	Anniston and Allen gravelly loams, 6 to 10 percent slopes, eroded
AcD2	Anniston and Allen gravelly loams, 10 to 15 percent slopes, eroded
AcE2	Anniston and Allen gravelly loams, 15 to 25 percent slopes, eroded
ACGIH	American Conference of Governmental Industrial Hygienists
AdE	Anniston and Allen stony loam, 10 to 25 percent slope
ADEM	Alabama Department of Environmental Management
ADPH	Alabama Department of Public Health
AEC	U.S. Army Environmental Center
AEL	airborne exposure limit
AET	adverse effect threshold
AF	soil-to-skin adherence factor
AHA	ammunition holding area
AL	Alabama
ALAD	-aminolevulinic acid dehydratase
amb.	Amber
amsl	above mean sea level
ANAD	Anniston Army Depot
AOC	area of concern
APEC	areas of potential ecological concern
APT	armor-piercing tracer
AR	analysis request
ARAR	applicable or relevant and appropriate requirement
AREE	area requiring environmental evaluation
ASP	Ammunition Supply Point
ASR	Archives Search Report
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
AT	averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
ATV	all-terrain vehicle
AUF	area use factor
AWARE	Associated Water and Air Resources Engineers, Inc.
AWWSB	Anniston Water Works and Sewer Board
'B'	Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero)
BCF	blank correction factor; bioconcentration factor
BCT	BRAC Cleanup Team
BERA	baseline ecological risk assessment
BEHP	bis(2-ethylhexyl)phthalate
BFB	bromofluorobenzene
BFE	base flood elevation
BG	Bacillus globigii
BGR	Bains Gap Road
bgs	below ground surface
BHC	betahexachlorocyclohexane
BHHRA	baseline human health risk assessment
BIRTC	Branch Immaterial Replacement Training Center
bkg	background
bls	below land surface
BOD	biological oxygen demand
Bp	soil-to-plant biotransfer factors
BRAC	Base Realignment and Closure
Braun	Braun Intertec Corporation
BSAF	biota-to-sediment accumulation factors
BSC	background screening criterion
BTAG	Biological Technical Assistance Group
BTEX	benzene, toluene, ethyl benzene, and xylenes
BTOC	below top of casing
BTV	background threshold value
BW	biological warfare; body weight
BZ	breathing zone; 3-quinuclidinyl benzilate
C	ceiling limit value
Ca	carcinogen
CAB	chemical warfare agent breakdown products
CAMU	corrective action management unit
CBR	chemical, biological and radiological
CCAL	continuing calibration
CCB	continuing calibration blank
CCV	continuing calibration verification
CD	compact disc
CDTF	Chemical Defense Training Facility
CEHNC	U.S. Army Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CESAS	Corps of Engineers South Atlantic Savannah
CF	conversion factor
CFC	chlorofluorocarbon
CFDP	Center for Domestic Preparedness
CFR	Code of Federal Regulations
CG	carbonyl chloride (phosgene)
CGI	combustible gas indicator
ch	inorganic clays of high plasticity
CHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
CK	cyanogen chloride
cl	inorganic clays of low to medium plasticity
Cl	chlorinated
CLP	Contract Laboratory Program
cm	centimeter
CN	chloroacetophenone
CNB	chloroacetophenone, benzene, and carbon tetrachloride
CNS	chloroacetophenone, chloropicrin, and chloroform
CO	carbon monoxide
CO_2	carbon dioxide
Co-60	cobalt-60
CoA	Code of Alabama
COC	chain of custody; contaminant of concern
COE	Corps of Engineers
Con	skin or eye contact
COPC	chemical(s) of potential concern
COPEC	chemical(s)/constituent(s) of potential ecological concern
CPSS	chemicals present in site samples
CQCSM	Contract Quality Control System Manager
CRDL	contract-required detection limit
CRL	certified reporting limit
CRQL	contract-required quantitation limit
CRZ	contamination reduction zone
Cs-137	cesium-137
CS	ortho-chlorobenzylidene-malononitrile
CSEM	conceptual site exposure model
CSM	conceptual site model
CT	central tendency
ctr.	container
CWA	chemical warfare agent
CWM	chemical warfare material; clear, wide mouth
CX	dichloroformoxime
'D'	duplicate; dilution
D&I	detection and identification
DAAMS	depot area air monitoring system
DAF	dilution-attenuation factor
DANC	decontamination agent, non-corrosive
°C	degrees Celsius
°F	degrees Fahrenheit
DCA	dichloroethane
DCE	dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DEH	Directorate of Engineering and Housing
DEP	depositional soil
DFTPP	decafluorotriphenylphosphine
DI	deionized

DID	data item description
DIMP	di-isopropylmethylphosphonate
DM	dry matter; adamsite
DMBA	dimethylbenz(a)anthracene
DMMP	dimethylmethylphosphonate
DOD	U.S. Department of Defense
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
DP	direct-push
DPDO	Defense Property Disposal Office
DPT	direct-push technology
DQO	data quality objective
DRMO	Defense Reutilization and Marketing Office
DRO	diesel range organics
DS	deep (subsurface) soil
DS2	Decontamination Solution Number 2
DWEL	drinking water equivalent level
E&E	Ecology and Environment, Inc.
EB	equipment blank
EBS	environmental baseline survey
EC_{50}	effects concentration for 50 percent of a population
ECBC	Edgewood Chemical/Biological Command
ED	exposure duration
EDD	electronic data deliverable
EF	exposure frequency
EDQL	ecological data quality level
EE/CA	engineering evaluation and cost analysis
Elev.	elevation
EM	electromagnetic
EMI	Environmental Management Inc.
EM31	Geonics Limited EM31 Terrain Conductivity Meter
EM61	Geonics Limited EM61 High-Resolution Metal Detector
EOD	explosive ordnance disposal
EODT	explosive ordnance disposal team
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EPIC	Environmental Photographic Interpretation Center
EPRI	Electrical Power Research Institute
ER	equipment rinsate
ERA	ecological risk assessment
ER-L	effects range-low
ER-M	effects range-medium
ESE	Environmental Science and Engineering, Inc.
ESMP	Endangered Species Management Plan
ESN	Environmental Services Network, Inc.
ESV	ecological screening value
ET	exposure time
EU	exposure unit
Exp.	explosives
E-W	east to west
EZ	exclusion zone
FAR	Federal Acquisition Regulations
FB	field blank
FD	field duplicate
FDA	U.S. Food and Drug Administration
Fe^{+3}	ferric iron
Fe^{+2}	ferrous iron
FedEx	Federal Express, Inc.
FEMA	Federal Emergency Management Agency
FFCA	Federal Facilities Compliance Act
FFE	field flame expedient
FFS	focused feasibility study
FI	fraction of exposure
Fil	filtered
Flt	filtered
FMDC	Fort McClellan Development Commission
FML	flexible membrane liner
FMP 1300	Former Motor Pool 1300
FOMRA	Former Ordnance Motor Repair Area
Foster Wheeler	Foster Wheeler Environmental Corporation
Frtn	fraction
FS	field split; feasibility study
FSP	field sampling plan
ft	feet
ft/ft	feet per foot
FTA	Fire Training Area
FTMC	Fort McClellan
FTRRA	FTMC Reuse & Redevelopment Authority
g	gram
g/m^3	gram per cubic meter
G-856	Geometrics, Inc. G-856 magnetometer
G-858G	Geometrics, Inc. G-858G magnetic gradiometer
GAF	gastrointestinal absorption factor
gal	gallon
gal/min	gallons per minute
GB	sarin
gc	clay gravels; gravel-sand-clay mixtures
GC	gas chromatograph
GCL	geosynthetic clay liner
GC/MS	gas chromatograph/mass spectrometer
GCR	geosynthetic clay liner
GFAA	graphite furnace atomic absorption
GIS	Geographic Information System
gm	silty gravels; gravel-sand-silt mixtures
gp	poorly graded gravels; gravel-sand mixtures
gpm	gallons per minute
GPR	ground-penetrating radar
GPS	global positioning system
GS	ground scar
GSA	General Services Administration; Geologic Survey of Alabama
GSBP	Ground Scar Boiler Plant
GSSI	Geophysical Survey Systems, Inc.
GST	ground stain
GW	groundwater
gw	well-graded gravels; gravel-sand mixtures
H&S	health and safety
HA	hand auger
HCl	hydrochloric acid
HD	distilled mustard
HDPE	high-density polyethylene
HEAST	Health Effects Assessment Summary Tables
Herb.	herbicides
HHRA	human health risk assessment
HI	hazard index
HPLC	high performance liquid chromatography
HNO_3	nitric acid
HQ	hazard quotient
HQ_{screen}	screening-level hazard quotient
hr	hour
HRC	hydrogen release compound
HSA	hollow-stem auger
HTRW	hazardous, toxic, and radioactive waste
'I'	out of control, data rejected due to low recovery
IATA	International Air Transport Authority
ICAL	initial calibration
ICB	initial calibration blank
ICP	inductively-coupled plasma
ICRP	International Commission on Radiological Protection
ICS	interference check sample
ID	inside diameter
IDL	instrument detection limit
IDLH	immediately dangerous to life or health
IDM	investigative-derived media
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
IF	ingestion factor; inhalation factor
ILCR	incremental lifetime cancer risk
IMPA	isopropylmethyl phosphonic acid
IMR	Iron Mountain Road
in.	inch
Ing	ingestion
Inh	inhalation
IP	ionization potential
IPS	International Pipe Standard

IR	ingestion rate
IRDMIS	Installation Restoration Data Management Information System
IRIS	Integrated Risk Information Service
IRP	Installation Restoration Program
IS	internal standard
ISCP	Installation Spill Contingency Plan
IT	IT Corporation
ITEMS	IT Environmental Management System™
'J'	estimated concentration
JeB2	Jefferson gravelly fine sandy loam, 2 to 6 percent slopes, eroded
JeC2	Jefferson gravelly fine sandy loam, 6 to 10 percent slopes, eroded
JfB	Jefferson stony fine sandy loam, 0 to 10 percent slopes have strong slopes
JPA	Joint Powers Authority
K	conductivity
KeV	kilo electron volt
K_{ow}	octonal-water partition coefficient
L	lewisite; liter
L/kg/day	liters per kilogram per day
l	liter
LBP	lead-based paint
LC	liquid chromatography
LCS	laboratory control sample
LC_{50}	lethal concentration for 50 percent population tested
LD_{50}	lethal dose for 50 percent population tested
LEL	lower explosive limit
LOAEL	lowest-observed-advserse-effects-level
LT	less than the certified reporting limit
LUC	land-use control
LUCAP	land-use control assurance plan
LUCIP	land-use control implementation plan
max	maximum
MB	method blank
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MCPA	4-chloro-2-methylphenoxyacetic acid
MCS	media cleanup standard
MD	matrix duplicate
MDC	maximum detected concentration
MDCC	maximum detected constituent concentration
MDL	method detection limit
mg	milligrams
mg/kg	milligrams per kilogram
mg/kg/day	milligram per kilogram per day
mg/kgbw/day	milligrams per kilogram of body weight per day
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mh	inorganic silts, micaceous or diatomaceous fine, sandy or silt soils
MHz	megahertz
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
MeV	mega electron volt
min	minimum
MINICAMS	miniature continuous air monitoring system
ml	inorganic silts and very fine sands
mL	milliliter
mm	millimeter
MM	mounded material
MMBtu/hr	million Btu per hour
MOGAS	motor vehicle gasoline
MOUT	Military Operations in Urban Terrain
MP	Military Police
MPA	methyl phosphonic acid
MPM	most probable munition
MQL	method quantitation limit
MR	molasses residue
MRL	method reporting limit
MS	matrix spike
mS/cm	millisiemens per centimeter
mS/m	millisiemens per meter
MSD	matrix spike duplicate
MTBE	methyl tertiary butyl ether
msl	mean sea level
MtD3	Montevallo shaly, silty clay loam, 10 to 40 percent slopes , severely eroded
mV	millivolts
MW	monitoring well
MWI&P	Monitoring Well Installation and Management Plan
Na	sodium
NA	not applicable; not available
NAD	North American Datum
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NAS	National Academy of Sciences
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
ND	not detected
NE	no evidence; northeast
ne	not evaluated
NEW	net explosive weight
NFA	No Further Action
NG	National Guard
NGP	National Guardsperson
ng/L	nanograms per liter
NGVD	National Geodetic Vertical Datum
Ni	nickel
NIC	notice of intended change
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NLM	National Library of Medicine
NO_3^-	nitrate
NPDES	National Pollutant Discharge Elimination System
NPW	net present worth
No.	number
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no-observed-adverse-effects-level
NR	not requested; not recorded; no risk
NRC	National Research Council
NRCC	National Research Council of Canada
NRHP	National Register of Historic Places
ns	nanosecond
N-S	north to south
NS	not surveyed
NSA	New South Associates, Inc.
nT	nanotesla
nT/m	nanoteslas per meter
NTU	nephelometric turbidity unit
nv	not validated
O_2	oxygen
O&G	oil and grease
O&M	operation and maintenance
OB/OD	open burning/open detonation
OD	outside diameter
OE	ordnance and explosives
oh	organic clays of medium to high plasticity
ol	organic silts and organic silty clays of low plasticity
OP	organophosphorus
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OVM-PID/FID	organic vapor meter-photoionization detector/flame ionization detector
OWS	oil/water separator
oz	ounce
PA	preliminary assessment
PAH	polynuclear aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
Parsons	Parsons Engineering Science, Inc.
Pb	lead
PBMS	performance-based measurement system
PC	permeability coefficient
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans

PCE	perchloroethene
PCP	pentachlorophenol
PDS	Personnel Decontamination Station
PEF	particulate emission factor
PEL	permissible exposure limit
PERA	preliminary ecological risk assessment
PES	potential explosive site
Pest.	pesticides
PETN	pentarey thritol tetranitrate
PFT	portable flamethrower
PG	professional geologist
PID	photoionization detector
PkA	Philo and Stendal soils local alluvium, 0 to 2 percent slopes
PM	project manager
POC	point of contact
POL	petroleum, oils, and lubricants
POW	prisoner of war
PP	peristaltic pump; Proposed Plan
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PPMP	Print Plant Motor Pool
ppt	parts per thousand
PR	potential risk
PRA	preliminary risk assessment
PRG	preliminary remediation goal
PS	chloropicrin
PSSC	potential site-specific chemical
pt	peat or other highly organic silts
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QAM	quality assurance manual
QAO	quality assurance officer
QAP	installation-wide quality assurance plan
QC	quality control
QST	QST Environmental, Inc.
qty	quantity
Qual	qualifier
'R'	rejected data; resample
R&A	relevant and appropriate
RA	remedial action
RAO	removal action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RDX	cyclonite
ReB3	Rarden silty clay loams
REG	regular field sample
REL	recommended exposure limit
RFA	request for analysis
RfC	reference concentration
RfD	reference dose
RGO	remedial goal option
RI	remedial investigation
RL	reporting limit
RME	reasonable maximum exposure
ROD	Record of Decision
RPD	relative percent difference
RRF	relative response factor
RSD	relative standard deviation
RTC	Recruiting Training Center
RTECS	Registry of Toxic Effects of Chemical Substances
RTK	real-time kinematic
SA	exposed skin surface area
SAD	South Atlantic Division
SAE	Society of Automotive Engineers
SAIC	Science Applications International Corporation
SAP	installation-wide sampling and analysis plan
sc	clayey sands; sand-clay mixtures
Sch.	Schedule
SCM	site conceptual model
SD	sediment
SDG	sample delivery group
SDZ	safe distance zone; surface danger zone
SEMS	Southern Environmental Management & Specialties, Inc.
SF	cancer slope factor
SFSP	site-specific field sampling plan
SGF	standard grade fuels
SHP	installation-wide safety and health plan
SI	site investigation
SINA	Special Interest Natural Area
SL	standing liquid
SLERA	screening-level ecological risk assessment
sm	silty sands; sand-silt mixtures
SM	Serratia marcescens
SMDP	Scientific Management Decision Point
s/n	signal-to-noise ratio
SO_4^{-2}	sulfate
SOP	standard operating procedure
SOPQAM	U.S. EPA's *Standard Operating Procedure/Quality Assurance Manual*
sp	poorly graded sands; gravelly sands
SP	submersible pump
SPCC	system performance calibration compound
SPCS	State Plane Coordinate System
SPM	sample planning module
SQRT	screening quick reference tables
Sr-90	strontium-90
SRA	streamlined human health risk assessment
SRM	standard reference material
Ss	stony rough land, sandstone series
SS	surface soil
SSC	site-specific chemical
SSHO	site safety and health officer
SSHP	site-specific safety and health plan
SSL	soil screening level
SSSL	site-specific screening level
SSSSL	site-specific soil screening level
STB	supertropical bleach
STC	source-term concentration
STD	standard deviation
STEL	short-term exposure limit
STL	Severn-Trent Laboratories
STOLS	Surface Towed Ordnance Locator System®
Std. units	standard units
SU	standard unit
SUXOS	senior UXO supervisor
SVOC	semivolatile organic compound
SW	surface water
SW-846	U.S. EPA's *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*
SWMU	solid waste management unit
SWPP	storm water pollution prevention plan
SZ	support zone
TAL	target analyte list
TAT	turn around time
TB	trip blank
TBC	to be considered
TCA	trichloroethane
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofurans
TCE	trichloroethene
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TDEC	Tennessee Department of Environment and Conservation
TDGCL	thiodiglycol
TDGCLA	thiodiglycol chloroacetic acid
TERC	Total Environmental Restoration Contract
THI	target hazard index
TIC	tentatively identified compound
TLV	threshold limit value
TN	Tennessee
TNT	trinitrotoluene
TOC	top of casing; total organic carbon
TPH	total petroleum hydrocarbons

TR	target cancer risk
TRADOC	U.S. Army Training and Doctrine Command
TRPH	total recoverable petroleum hydrocarbons
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
TWA	time-weighted average
UBR	upper background range
UCL	upper confidence limit
UCR	upper certified range
'U'	not detected above reporting limit
UF	uncertainty factor
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAEC	U.S. Army Environmental Center
USAEHA	U.S. Army Environmental Hygiene Agency
USACMLS	U.S. Army Chemical School
USAMPS	U.S. Army Military Police School
USATCES	U.S. Army Technical Center for Explosive Safety
USATEU	U.S. Army Technical Escort Unit
USATHAMA	U.S. Army Toxic and Hazardous Material Agency
USC	United States Code
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
UTL	upper tolerance level; upper tolerance limit
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Supervisor
UXOSO	UXO safety officer
V	vanadium
VOA	volatile organic analyte
VOC	volatile organic compound
VOH	volatile organic hydrocarbon
VQlfr	validation qualifier
VQual	validation qualifier
VX	nerve agent (O-ethyl-S-[diisopropylaminoethyl]-methylphosphonothiolate)
WAC	Women's Army Corps
Weston	Roy F. Weston, Inc.
WP	installation-wide work plan
WRS	Wilcoxon rank sum
WS	watershed
WSA	Watershed Screening Assessment
WWI	World War I
WWII	World War II
XRF	x-ray fluorescence
yd^3	cubic yards

ATTACHMENT 2

MEMORANDUM FOR RELEASE OF PROPERTY TO CONDUCT HTRW INVESTIGATIONS

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

September 7, 2001

Environmental and HTRW Section
Engineering Division

IT Corporation
Attention: Mr. Steve Moran
312 Directors Drive
Knoxville, Tennessee 37923-4799

Dear Mr. Moran:

Reference is made to your Contract DACA21-96-D-0018, Task Order CK10, WADs 1, 2, 9, and 10, at Fort McClellan, Alabama.

The Corps of Engineers Huntsville Center has completed its CWM EE/CA and has received all soil sample results. All of the samples were clear of Chemical Warfare Material and Chemical Warfare Material by-products. A copy of Huntsville's letter is enclosed for your files.

You are now authorized to begin the monitoring well installations within these areas as approved in your work plans.

Should you have any questions, please contact me at (334) 690-3077.

Sincerely,

Ellis C. Pope

Encl

Ellis C. Pope
Authorized Representative of the
Contracting Officer

Cf: Mr. Ron Levy
BRAC Environmental Coordinator
U.S. Army Garrison/Transition Force
Environmental Office
291 Jimmy Parks Boulevard
Fort McClellan, AL 36205-5000

DEPARTMENT OF THE ARMY
HUNTSVILLE CENTER, CORPS OF ENGINEERS
P.O. BOX 1600
HUNTSVILLE, ALABAMA 35807-4301

REPLY TO
ATTENTION OF:

CEHNC-OE-DC (200-1c) 5 September 2001

MEMORANDUM FOR Commander, U.S. Army Engineer District, Mobile, ATTN: Ellis Pope (EN-GE), P.O. Box 2288, Mobile, AL 36628-0001

SUBJECT: Chemical Warfare Material (CWM) Engineering Evaluation/Cost Analysis (EE/CA) Completion and Release of Property for Hazardous, Toxic, and Radioactive Waste (HTRW) Investigations, Fort McClellan, AL

1. The CWM EE/CA for Fort McClellan has been completed and the results from all the soil samples have been received. All of the samples were clear of Chemical Warfare Material and Chemical Warfare Material by-products.

2. The HTRW investigations can be started on the Chemical Warfare Material Sites that were completed during this investigation using anomaly avoidance and withdrawal if suspect chemical weapons are found.

3. If you have any questions, please call Mr. Dan Copeland at 256-895-1567.

FOR THE DIRECTOR OF
ORDNANCE AND EXPLOSIVES DIRECTORATE:

JOHN C. POTTER, Ph.D., P.E.
Chief, Design Center
for Ordnance and Explosives
Directorate